# Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, NOVEMBER 20, 1915 No. 21

## Getting a "News Sense" of the Industry

KNOWLEDGE of fundamentals and specialized training in one line are necessary and important for the electrical engineering student. It is hardly fair, either, to assume that the younger men about to enter the industry should accomplish more than their elders. Yet observation shows that the rank and file of men in the engineering schools and colleges are lacking in what the city editors of newspapers call "a nose for news." Students seem to be interested in past developments in their chosen profession, either as a matter of record or as a check on book knowledge. This interest is to be commended as far as it goes. But quite as important are the far-reaching, week-to-week activities within the industry which are history in the making. The development of electrical heating for domestic and industrial uses, for example, is news. It is news not only because of mere freshness in interest, but also because it marks the breaking down of the barriers to a relatively untilled field of design and applied electrical engineering. The fact that the Pacific Coast is ordering ranges in carload lots, the fact that basic patents are being sold and bought for thousands, the fact that central stations are reducing rates for domestic heating, all are news of engineering and commercial significance. Progress in electric heating is merely a sample of a dozen other subjects. Alertness is a quality of mind that counts much in individual accomplishment. The reading, and the reflection that may follow the reading, of news of the industry is a tonic for freshman or senior, whether he is going to school at college or in business. Possibly a reason for the students' lack of interest follows because mathematical and other engineering problems at school are tangible—the statement of the problem and the answer are in sight at the same time. Broad engineering questions are less tangible and therefore inherently less interesting to the student. He would be fascinated with them did he appreciate their significance.

## Higher Temperatures for Built-up Insulation

SHOULD the allowable temperature limit for built-up mica insulation be raised to 150 deg. C., as suggested at last week's meeting of the American Institute of Electrical Engineers? Evidently it may be advisable, if consideration is given to how and where the apparatus will be used and what voltage will be employed. One of the benefits from raising the temperature limit for mica is realized, for instance, in turbine-driven generators operating single-phase. Under these conditions radiation can be safely sacrificed to permit decreasing the diameter of rotors and thereby allow higher speeds and consequently higher steam economies. On the other hand, if machine ratings are based on the higher temperature limit, there will not be the margin of safety which is so important in emergencies and is now obtained within present temperature limits. Further information should, however, be secured to show the effect an increase in temperature will have on the reliability of operation. Can wire-wound coils be satisfactorily insulated with built-up mica, and will such insulation safely withstand high voltages at high temperatures? Will vibration, such as is set up by magnetic pulsations in single-phase units, destroy mica, and are there other substances which will withstand high temperatures and have more desirable qualities? Are the binders which are suitable for making built-up insulations capable of withstanding high temperatures, and will the coils become loose in the slots when the insulation is dried out and the wrapping disintegrated? Lastly, if existing mica-insulated machines be operated at higher temperatures, will the intermittent expansion of the conductors due to extreme changes in temperature be large enough to grind out the insulation, set up stresses, or cause displacements? Since all of these points will probably be considered by the A. I. E. E. standards committee, every engineer who has had experience with insulations should take this opportunity to point out service restrictions and requirements.

## Increasing Load-Factors

ONE of the reasons for the stability and prosperity of the central-station industry for many years has been the gradual increase in annual load-factors which has been taking place since the earliest days of the business. This has had an important influence in reducing the cost of production. It has, of course, been due to a more diversified use of electricity and the supplying of lighting and railway service from the same station. In the old days when peak-load lighting was the principal source of income load-factors from 15 to 25 per cent were common. Now load-factors in excess of 35 per cent are frequently found, while a very common range is between 25 and 35 per cent. Though this is due primarily to new uses for electricity and to a diversity in the time of demand made by different consumers, there is also to be noted a gradual increase in the load-factors of some classes of individual consumers. A prominent central-station man in private conversation recently noted that there seems to be an increase in load-factors from year to year all along the line. For example, large hotels have increased their annual load-factor from 50 per cent to 60 per cent. This is partly due to

more diversified use of electricity within the building, as for refrigeration and for miscellaneous appliances which increase the comfort of guests. Factories are studying methods of operation which will give better load-factors for their motor load, and consequently better rates. One notable instance was the shifting backward of the working day so that the factory would close in the afternoon before the evening peak. This upward tendency is gratifying from the central-station companies' standpoint as well as from the standpoint of general economics and the ultimate welfare of the country as a whole in making the best use of invested capital. Low load-factors mean idle equipment and therefore economic waste. High load-factors consequently are practical examples of the conservation of resources.

---

### A National Electrical Council

A RECENT editorial called attention to the need of nationalizing the work of the associations and societies for the advancement of the science and industry. President Harding of the Electric Power Club in his presidential address likened the present associations to the different states in a national union, each state working broadly along national lines but each concerned also with its own internal and local affairs. He emphasized, as have the past and present presidents of the National Electric Light Association and the American Institute of Electrical Engineers, the possibility of an electrical executive council, made up of representatives of the "states" together co-ordinating those activities of each group organization which have a common object. There is need for such a national body. We should like to see steps taken to put such a plan into action.

---

### Tendencies in the Design of Diffusing Glassware

IN the evolution of lighting appliances the development of diffusing glassware of various kinds has been a very important factor, and a great deal of ingenuity has been spent in producing a uniform and effective article. In spite of this there are very great differences between the types of diffusing glass which are in current use. They vary in absorption factor from 15 to 35 or 40 per cent, and in the effect produced from a moderate general diffusion to diffusion so complete that the visible illuminated area is extraordinarily uniform in intensity. A plea may well be made for a more thorough study of the commercial types available in order that the illuminating engineer shall have reasonably accurate data upon which to work. The introduction of the gas-filled lamps makes diffusive protection of greater importance than ever, and it must be obtained without too much loss and without selective absorption. Transparent glass merely depolished and acting in virtue of surface diffraction is for certain purposes excellent, as it involves only moderate loss of light and confers a certain large and pleasing effect of central brilliancy which for some purposes is desirable. It is, besides, free from selective absorption. As to the earlier forms of opal or milk glass suitable for diffusing purposes, the common failing is high absorption, frequently coupled with enough transparency to make the lamp filament plainly visible, and often accompanied by strong selectivity. In fact, the earlier glasses might be divided into two classes, one of which gave selective absorption in the red and yellow and the other in the blue. Some of the early experiments on flaming arcs gave most extraordinary results owing to the use of a glass belonging to the former of the types just referred to, which absorbs strongly the very rays that are the most brilliant in the yellow flame.

Of late there have been developed a number of beautiful types of diffusing glass which conceal the filament and have very small selectivity, while still giving diffusion entirely adequate for most purposes. Selective absorption is not always objectionable, as witness the toning of incandescent lamps toward daylight effect by its use and the modification of the white intensity of some of the modern light sources toward a pleasanter tint. The absorptive coefficients of various glasses have been from time to time measured, but we know of nothing like an exhaustive study of the varieties of diffusing glass which are now available, and work of this kind ought to be undertaken on a comprehensive scale at a very early date. Perhaps the most effective procedure would be to use the gas-filled lamp with a straight vertical filament in the integrating sphere or other integrating form of photometer. Measurements made in any other way are quite certain to lead to errors owing to variations of distribution, and even the sphere, being a closed, reflecting space, gives results not quite comparable with those obtained in the open. We fancy that the results of a study of the dozen or more commercial varieties of glass would lead to some rather surprising results, particularly if, as should be the case, due account were taken of the selective absorption. The data are badly needed and ought to be accumulated.

---

### Controlling Infra-Red Emission

ONE of the most interesting fictions which careful study in thermodynamics has produced is the fiction of a "black body." It is well known that a highly polished surface enables a metallic vessel, such as a silver teapot, to conserve its heat or to cool off less rapidly. If, however, the surface is allowed to tarnish, and particularly if it be given a suitable dull-black finish, the rate of heat radiation from the vessel will be considerably accelerated. A black body, in the thermodynamic sense, is one which can reflect no radiation of any wave-length. It absorbs all incident radiation. On the other hand, however, a black body can, for a closely associated reason, radiate heat energy of any or all wave-lengths with the maximum celerity, or on what may be called the "easy-come easy-go" principle. When a black body is raised to an incandescent temperature, it shines with a continuous spectrum, but it has the lowest possible luminous efficiency, as it dissipates dark heat with perfect radiant effectiveness all through the infra-red spectrum.

Physicists say that no known substance behaves like a perfect black body all through the radiant-energy spectrum. The quantitative power relations in the spectrum of a black body have already been deduced, and some substances conform very nearly to these relations, except perhaps in a particular region or band, where the radiation falls short. A plain untreated carbon filament, in an incandescent lamp, is said to give a fair approximation to a black body. Of course, what is desirable for an incandescent lamp, as has long been known, is the reverse of a black body—i.e., a white body, so to speak—which should fall far short of full black-body radiation in the dark or infra-red spectrum when raised to a glowing temperature. It has been pointed out repeatedly in textbooks on the subject that such a body, if able to withstand a high temperature, would be ideal for incandescent lighting, although it is doubtful whether the whitest of white bodies can finally compete with a good incandescent-vapor lamp, since a vapor can radiate wholly in one particular band of the spectrum, and possibly with that band in the middle of the light-giving spectrum, whereas a white solid body can only be expected to save some of the waste pouring out in dark radiation.

## Taking a Census of Consumers

WAR focused attention on business essentials. It has served as a forced stimulant to better methods in many a business which before had been jogging along comfortably but rather wastefully and overlooking opportunities near at hand that seemed relatively unimportant. The period of retrenchment, of sharp cutting off of money outgo in all forms, is past. We are in a period of intelligent reconstruction after a rather long period of taking inventory of every factor. Scarcely a business has come through this period of stress without a greater respect for its market possibilities. Energy which could not go into producing during the war period has been turned to analysis and research. In one central station men who otherwise would have been thrown out of employment were retained in a statistical investigation of prospective customers. A house-to-house canvass of the community was made, with the result that now, with the return of more prosperous conditions, the market possibilities of that community are understood as never before. A census of customers is a very useful sales asset. Every day-and-night residence connected is a possible source of revenue, not only from lighting but from the sale and use of washing machines, vacuum cleaners, toasters, percolators, and, with a low rate, the electric range. How many stations are there with an actual knowledge of just how large this market is? As a question of determining the future size and location of feeders and mains, present and future demands are quite as important from an engineering as from a commercial standpoint. Engineering analyses of customers have been made the basis for the work of both plant and operating departments in telephone work. The average lighting company can borrow a leaf from the telephone company's book of experience.

## The Right to Choose Customers Upheld

DIRECTORS of electrical business will be interested in the recent decision of the United States Court of Appeals in the case of the Great Atlantic & Pacific Tea Company versus the Cream of Wheat Company. The Cream of Wheat Company refused to sell its product to the tea company because the latter concern sold cream of wheat below the advertised price. The tea company complained that the refusal to supply it with cream of wheat was an illegal discrimination under the Clayton law. Judge Hough of the United States District Court for the Southern District of New York rendered an opinion last July establishing the right of the maker to be free to choose his customers.

Judge Hough has now not only been upheld, but the Court of Appeals seems to have been infected with some of the spirit that characterized the decision below. Judge Lacombe, for example, remarks in his opinion: "We had supposed that it was elementary law that a trader could buy from whom he pleased and that his selection of seller and buyer was wholly his own concern. It is part of a man's civil rights that he is at liberty to refuse business relations with any person whomsoever, whether the refusal rests upon reason or whether it is the result of whim, caprice, prejudice or malice."

That seems plain enough, and after reading it the layman may wonder what has been bothering the manufacturer with respect to his liberty to sell or to refuse to sell his products as he might see fit. Whim, caprice, prejudice and malice, collectively, seem to be fairly inclusive of the motives—now legally approved—that might induce a producer to refuse to sell to a given customer. But it must not be forgotten that the court has not said that a refusal to sell is justified if the purpose or result of such refusal is to create unreasonable monopoly and restraint of trade. The two decisions are so worded that this important fact may be overlooked. We may act on caprice or malice, but restraint of trade is still forbidden.

It is an unavoidable consequence of the rulings in the cream of wheat case that the burden of proof to show an improper motive in the choosing of customers will hereafter lie heavily upon the plaintiff or prosecution. Under a reasonable application of Judge Hough's and Judge Lacombe's decision, it would seem that every assumption is in favor of the defendant, and that it will be the part of complainants to prove that objectionable actions are not due to caprice but are plainly dictated by a desire to restrain trade. For some years we have had—with the notable exception of the announcement of the rule-of-reason doctrine—a long line of decisions the effect of which was to sharpen the teeth of our anti-trust laws and almost to create panic among those who wanted to obey the law whatever it was and at the same time conduct their business successfully. The cream of wheat decision represents a decided reaction from strict construction of anti-monopoly laws, at least so far as the important matter of choosing customers is concerned.

## Kansas Tornado Wrecks Plant of the Great Bend Electric Light Company—Service Resumed with Temporary Equipment Assembled from Machinery of Demolished Station

The tornado which swept through Kansas and neighboring Western States on the evening of Nov. 10 wrought its principal damage in the town of Great Bend, Kan., where the high wind leveled homes and industrial plants and caused damage estimated as about $1,000,000. The plant of the Great Bend Water & Electric Company was in the path of the storm, and the building, a one-story brick structure, was demolished, as shown in the accompanying picture. Although the building itself was blown down by the high wind, investigation of the ruins disclosed the injury to the equipment to be less serious than might have been expected. Electrical machinery manufacturers sent men from their Kansas City offices to assist in getting the Great Bend plant into temporary operation, and it was expected that by Nov. 17 the street lamps would again be in operation and that power would also be available for pumping at the water-works plant. Electricity for residence lighting and for other power uses will be turned on later. Fortunately, about six weeks before the storm the company had ordered two oil engines and new generators and had already planned the installation of extensive new equipment, which will be erected as soon as it can now be delivered. Temporary service is being resumed meanwhile with the machinery from the wrecked building.

A Chronicle of Events of the Industry and of Important Movements in the Field

# NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

### Ohio Commercial Men Discuss Sale of Motor Service at Middletown Meeting

In opening the meeting of the commercial men of the Ohio Electric Light Association at Middletown, Ohio, Nov. 17, L. C. Anderson, treasurer and manager of the Middletown Gas & Electric Company, declared that the whole country is now on the eve of an era of prosperity, upon which the continuance or ending of the European war will have but little effect. He urged the delegates as salesmen to take advantage of this favorable business situation for the benefit of their companies.

The three papers on the program—"Electrical Advertising," by W. A. Wadsworth of Cincinnati; "Power Sales Problems," by H. J. Kunz of Toledo, and "Increasing Small Motor Load on Central-Station Circuits," by F. S. Dellenbaugh of East Pittsburgh, Pa.—were disposed of before early afternoon to give the delegates an opportunity to visit the plant of the American Rolling Mill Company. J. E. North of Springfield, chairman of the new-business co-operations committee of the Ohio Electric Light Association, presided at the meeting.

Commercial managers, salesmen and other central-station men in attendance at the meeting evinced much interest in the plans for Electrical Prosperity Week, and reported at length upon the arrangements made in their own cities for carrying out local celebrations.

### New Industrial Electric Heating Association to Meet at Detroit Next Week

The Industrial Electric Heating Association, which was formed early last spring, will hold its first convention at Detroit, Mich., on Nov. 26 and 27. The tentative program includes papers by C. F. Hirshfield of Detroit, Frank Thornton of Pittsburgh, J. A. Seede of Schenectady, and H. J. Kunz of Toledo. Arrangements are being made for exhibiting newly developed industrial electric-heating equipment at the convention.

### Manufacturers Discuss Economic Conditions Due to the European War

Addressed by the presidents of five organizations of manufacturers, representing 1500 members and an investment of $14,000,000,000, the opening meeting on Nov. 17 of the two-day session of the National Founders' Association at the Hotel Astor in New York City marked a start toward the co-operation of American industries to face the serious economic situation which, it is expected, will result in the world's markets, and particularly in the United States, on the signing of peace articles in Europe.

Because it is expected that on the conclusion of hostilities in Europe American business will have to cope with the sudden displacement caused by the cessation of war orders, thereby reducing profits in many lines at a time when a corresponding reduction of wages will be difficult, and because there will also be a scarcity of skilled labor due to the losses of life in the war, which it is feared may greatly increase the price of labor, it has become desirable from the manufacturers' point of view to start now in the hope of extending the use of machinery in many operations.

In the great association which was talked of each of the existing employers' organizations will have its own field of activity, but all will be co-ordinated under the central body.

The meeting was addressed by the following presidents of manufacturers' associations: William H. Barr of the foundry men, H. H. Rice of the National Metal Trades Association, Col. George Pope of the National Association of Manufacturers, John P. Wood of the National Association of Woolen Manufacturers, and Albert G. Duncan of the National Association of Cotton Manufacturers.

At the evening banquet Charles Nagel, former Secretary of Commerce and Labor, spoke favoring a constructive national industrial program, based on sound principles of economics and economy.

**Report of Conference on Valuations Held at Philadelphia, Nov. 10, 11 and 12, by Public Service Commissioners—Wide Variety of Opinion on Different Methods of Determining Public Utility Valuations**

# On What Basis Shall Public Utilities Be Valued?

REPRODUCTION theory, original cost, franchise values, valuing land, depreciation, going value and valuation of the future of public utilities were discussed in a conference on valuation held in Philadelphia, Nov. 10, 11 and 12, under the auspices of the Utilities Bureau. The seven sessions were well attended by valuation engineers, public service commissioners, accountants, and representatives of municipally owned utilities, those representing privately owned utilities being conspicuous by their absence.

Judging from the discussion contributed by various public service commissioners, there is almost as wide a divergence of views between the public service commissions of the various States as to what shall and what shall not constitute the elements of a valuation of public utilities as there is between the utilities and the commissions. Most of the commissioners were in accord with the proposition that the reproduction theory of valuation should at best be considered as only one factor in establishing fair value. In many cases there was a disposition to regard actual original cost as the most equitable basis for valuing existing utilities. In determining the value of utilities to be laid down in the future, the trend of opinion was that this valuation shall be determined on the actual amount of money honestly invested in the property.

Although depreciation and going value were discussed at some length, the various interpretations of opinions cited by the different speakers served only to becloud the issue. With reference to the subject of going value, the leading speakers believed that, while an allowance should be made for the actual cost of establishing and developing the business in its early years, nothing should be included in the valuation total for the so-called "good-will" factor resulting from the enhancement in the value of the company's physical property arising from its operation as a going and profitable concern.

The custom inaugurated at the initial conference last year of obtaining the sense of the meeting before adjournment was not followed this year. Last year the conference, while recommending no general conclusion upon the abstract question of municipal ownership, declared that the franchise-making power should in all cases be local, that municipally owned utilities should be subject to local control only, that in large cities local regulation is plainly to be preferred, and that in all cases the principles of home rule should be preserved by at least leaving it to the people of a city to determine whether they desire to act for themselves or to call in a State board, if one exists, either to regulate or to aid the local authorities in regulating privately owned local utilities.

---

IN his opening remarks Morris L. Cooke, director of public works, Philadelphia, and acting director of the Utilities Bureau, said that most discussions between cities and municipally owned utilities on the one hand and privately owned utilities on the other are of interest to a middle group, comprising not the actual investors in the private companies or their actual operators, but those who market their securities. He believed that disputed questions could be settled harmoniously between investors and public interests were it not for this middle group.

### John M. Eshleman, Former President of California Railroad Commission, Opposes in General the Reproduction Theory of Valuation.

The first address on the reproduction theory of valuation was delivered by John M. Eshleman, Lieutenant-Governor of California and former president of the California Railroad Commission. Mr. Eshleman coined the term "threat price," and said that in competitive industries the tendency to exact a threat price is regulated within reasonable bounds by actual or potential competition. All monopolies possess the power of imposing a threat price and of producing a threat value to the patron, so that it becomes necessary to guard against it.

While opposed to the general reproduction theory, Mr. Eshleman stated that the historical method of reproduction is extremely valuable in supplying secondary evidence of original cost when the primary evidence is lost.

The proper amount upon which the utility should be permitted to earn in each case is an amount to be determined only by the governmental authority after consideration of all the facts, historical and otherwise, all the engineering and accounting data, and everything to be learned about the utility that is under investigation.

When government is dealing with monopoly it must of necessity deprive such monopoly of the power of taking all that it can get from its patrons. In this case the government must determine as a substitute what the monopoly ought to receive, and in this the safest and most just guide is what the agency has sacrificed and what service it has performed for the public and the community.

For the past there should be allowed such a valuation basis for earnings as equitable considerations warrant. For the future, according to Mr. Eshleman, an inducement which the investor is willing to accept must be held out as long as there is private ownership of utilities. The cost of doing business plus a return upon the capital necessarily invested in the business, which return shall be as great as that offered in other businesses of similar hazard, is all that ought to be granted, declared the speaker.

### Reproduction Value May Form the Basis of Determining a Fair Present Value, in the Opinion of H. Findlay French.

H. Findlay French, attorney-at-law, Baltimore, Md., gave an address on the relation of reproduction value and fair value. Mr. French said that under the reproduction method as applied the calculations are based upon the costs of labor and materials as they exist today, whereas those costs have been steadily rising for years, so that the values obtained by this method are almost certain to be higher than the actual costs incurred by the public utility. To be absolutely just it would be necessary to change the value of the property of the public utility companies each time that there was a fluctuation in the prices of labor and materials, and such a change would lead to unstable and undesirable

conditions. In Mr. French's opinion, however, the reproduction method has a true value in that it is of service in ascertaining the present value. To obtain the fair value of the property of a public utility company it is necessary to take every relevant fact into consideration, and reproduction value is only one and by no means the most important of the many relevant facts.

The discussion was opened by Prof. Morris Knowles, director of the course in valuation of public utilities, University of Pittsburgh. He felt that estimates of the cost of reproduction are useful only when carefully and honestly made. Instances of intended inflation of this figure, however, are rare, and he objected strongly to the suggestion that reproduction cost and the current methods of estimating it were invented by engineers for the purpose of maintaining high rates of utility companies. From the point of view of existing law, the speaker believed that a perusal of court decisions can lead to no other conclusion than that the cost of reproduction is the most important item of evidence in determining present value, and that upon it, with occasional modification, most of the decisions have actually been made. There is a sense of compensation, of reciprocity, in the word "return," and in equity when one speaks of a fair return he means not a reasonable income upon some kind of valuation, but a giving back to the investor of a complete and fair equivalent for what he has devoted to the public service.

A. B. Du Pont, consulting engineer, Cleveland, Ohio, was of the opinion that value varies directly in proportion to expected profits and inversely in proportion to risk. He introduced several illustrations to show the difficulties of comparing two similar utilities on the basis of reproduction cost and summed up by saying that value is not dependent upon reproduction cost but upon the price of capital, the difference between expected earnings and expected expenses and the future activities of the utility within the limits expected to be imposed by government.

James E. Allison, consulting engineer, St. Louis, Mo., expressed the thought that it is not the business of commissions and other valuation bodies to find an existing value. Their duty is to create a value that will be a just amount, based upon the exact sacrifice of the enterprise—in other words, the value that would have induced the creation of the utility. Then upon this value a satisfactory rate of return must be allowed.

Mr. Eshleman pointed out that "value" should be left out of the discussion, for what is being sought is simply an equitable amount that can be used as a basis upon which to allow earnings or to set a purchase price for the property.

**George W. Anderson, Boston Attorney, Believes that Rates Should Be Calculated on Basis of Capital Furnished by the Public Utility.**

The session on Thursday morning was called to order with C. W. Kutz, chairman District of Columbia Public Utilities Commission, in the chair. Before introducing George W. Anderson, attorney-at-law, Boston, Mass., as the first speaker, Mr. Kutz described the beginnings of valuation work accomplished by his commission since a suitable appropriation was obtained a year and a half ago.

Mr. Anderson said that the reproduction-cost theory is a menace to public safety, for it is not capable of sound and honest administration. The courts adopted the fair-value concept simply because the legislatures did not act, although the function of the courts is only to interfere to prevent confiscation. Mr. Anderson enumerated the only two things which to his mind are furnished by the private investor—i.e., money and management—and held that the actual investment is in general all upon which the investor has a right to secure a return. For future cases the actual investment should be the criterion of valuation, while for existing properties the right to include land grants, etc., depends entirely upon specific factors in the company's history or any contract provision in its charter whereby the basing of a return solely upon the actual investment is prevented. He advocated that national and state laws be passed requiring that rates be calculated on the basis of the actual capital furnished by the utility.

**Edward W. Bemis of Chicago Defines Original Cost in the Case of Physical Assets as the Actual Cost of Property Now in Use.**

Prof. Edward W. Bemis of the Board of Supervising Engineers, Chicago, Ill., spoke on original cost as the chief basis for fair value. He defined original cost in the case of physical assets as the actual cost of the property now in use. In reproduction cost an attempt is made to determine the present-day costs of replacing the existing property if it were suddenly removed or destroyed. In both cases depreciation, or the estimated decline in units of service, should be considered. Estimates also are necessary in both lines of investigation, but with the important difference that reproduction cost is all an estimate, based on current prices of labor and materials, while the original cost is only partly based on estimates, being obtained in large degree, and in some cases almost in its entirety, from the records of the company. The speaker said that the tendency to rely only upon reproduction cost has of late received many a deserved blow. Actual cost appeals to one's sense of justice and fair dealing and leads to security of investment more than does the reproduction cost.

The discussion was opened by Robert H. Whitten, secretary of the Board of Estimate and Apportionment committee on the city plan, New York City. Mr. Whitten believed that under regulation the reasonable rate is that fixed by the normal cost of production, which is itself determined by the normal cost of labor and materials, the proper amount of depreciation, and a fair return on the capital cost. As a general proposition the public is entitled to a cost that is based on the reproduction of the service rather than of the identical plant. Yet the reproduction theory in practice has deteriorated to involve the reproduction of an identical plant. Mr. Whitten stated that any basis fair to all parties must sooner or later get back to actual capital cost. Utility service is continuous, and present cost is as much a result of past life as of present conditions. Normal actual cost has one advantage from the public point of view in that it does not involve fluctuations in cost, and no utility should be expected to assume the risks of speculation in land, materials and the like.

Edward P. Burch, consulting engineer, Detroit, Mich., was of the opinion that original cost can seldom be known and must be determined from secondary evidence secured by the reproduction method. Yet so far as the cost can be based upon the actual sacrifice of the investor, one important factor not complicated with hazy intangibles is obtained for a rate basis.

F. W. Stevens, general valuation counsel New York Central Lines, said that he never had been and is not now in favor of the unqualified statement that rates should be based on original cost. He did not believe that such a method is workable or just in a large number of cases, although in some cases it is absolutely right.

Frederic P. Stearns, consulting engineer, Boston, Mass., heartily agreed with the idea that actual cost should be the basis for the future, and he supported the plea for legislation to permit the use of this basis.

**Physical Valuation on the Basis of Priced Inventories Discussed by Charles L. Pillsbury, District of Columbia Public Utilities Commission.**

The subject of the making and maintenance of priced inventories was taken up by Charles L. Pillsbury, chief engineer of the valuation bureau, District of Columbia Public Utilities Commission.

Mr. Pillsbury said that the inventory of physical items should be a matter of fact, not of controversy, and disputes should be settled in the field and not in court. Inventories can be maintained to advantage by the operating companies. The public will pay the cost in any case, as the inventory maintenance will become an operating cost. A permanent valuation staff should be organized within the company, and the maintenance of the inventory will become a much more simple task than is generally assumed. A large proportion of the requisite data can be obtained almost automatically and with moderate extra labor. Inventory maintenance in this manner would result in highly desirable standardization of purchasing and construction methods and cost-keeping.

Mr. Pillsbury's paper was discussed by James W. Phillips of the grade-crossing division of the Bureau of Survey, Philadelphia, Pa.; F. W. Ballard, commissioner and chief engineer of the division of light and heat, Cleveland, Ohio, and R. J. Meigs, valuation engineer of the Western Union Telegraph Company, New York. Mr. Meigs was of the opinion that the future use of the inventory data should be taken into consideration in making the inventory. He emphasized the importance of co-operation between commissions and utilities in making inventory investigations and said that the lack of a uniform method, a uniform understanding and general broad-mindedness were adverse influences in inventory work that should be overcome.

**John G. Morse of Factory Mutual Insurance Companies Explains Methods of Securing Accurate Values on Basis of Approximate Appraisals.**

The presiding officer at the Thursday afternoon session was L. S. Rowe, president American Academy of Political and Social Science. Before the main topic of the session, franchise values, was taken up, a paper by John G. Morse, appraiser of the Associated Factory Mutual Fire Insurance Companies, Boston, Mass., on the subject of valuation by approximation was read and discussed.

Mr. Morse described the methods of his organization whereby an accurate appraisal of manufacturing property for insurance purposes is made in a few days of actual field work and a few more of office work. He asserted that it is useless to waste time on minor detail in appraisal work when a large proportion of such work must of necessity be based on estimate. Mr. Morse said that it would take very little effort to demonstrate to any court how largely estimate enters into any appraisal and that an appraisal made on broad common-sense lines can be just as accurate as one made in great detail.

The advantages of valuation by approximation were discussed by Mr. Cooke and W. N. Polakov, consulting engineer, Stamford, Conn. The plan of making inventories in minute detail possessed little value according to Mr. Cooke, who cited the case of the inventory made by the Philadelphia Electric Company at an approximate cost of $200,000. This might have been cut to one-fifth that amount had valuation by approximation been used. He maintained that manufacturing and industrial establishments underestimate the value of inventories, whereas public-utility companies lay entirely too much stress on valuations. Moreover, he contended that public-utility valuations are not made with a view to ascertaining the cost of service but solely for financial reasons.

The necessity for minuteness of inventories, Mr. Polakov thought, was not nearly so important as care in operation. In the New Haven power plants he was able to cut operating expenses 25 per cent without adding a cent to the investment by merely changing the methods of operation. It was pointed out by Mr. Stevens, however, that minuteness in inventory is a necessity in many cases. In a case in which he is interested the addition of only 1 cent to the value of a railroad tie would increase the value of that one item by $500,000.

**The Relation of Franchises to Values Discussed in Detail by Dr. Delos F. Wilcox, Deputy Commissioner of Water Supply, Gas and Electricity, New York.**

The first address on the subject of "Franchise Values" was by Dr. Delos F. Wilcox, deputy commissioner of the department of water supply, gas and electricity, New York City, and consulting franchise and public-utility expert. Dr. Wilcox took up the various principles of franchise values as concerned in valuations for the purpose of (1) taxation, (2) rate-making, (3) condemnation, (4) involuntary sale, (5) voluntary purchase, and (6) capitalization. In connection with the first point he stated that it is admissible to tax franchise values without reference to the possibility of their being reduced or destroyed in the future by any means. The duration of the franchise and the fixity of rates are important indirectly as they affect the security of the property or its earning power and thus increase or decrease the fair rate of return.

In relation to franchise values in rate-making cases, Dr. Wilcox said that the valuation in a tax case has no significance. Where franchise value is allowed for an original compensation paid for the instrument, it must be based on actual cost or assumed actual cost, without depreciation where the franchise is perpetual and with proportionate depreciation where its life is limited.

In condemnation proceedings the present worth of the prospective earning power, based on fair and reasonable future rates, is the real criterion. Fixed rates are an important consideration, but in some cases they may prove disadvantageous to the corporation. Public regulation with its requirements results in a tendency toward conservative franchise valuations. The chief value of a perpetual franchise consists of the life and security it gives the physical property, and any attempt to measure its separate value is almost certain to lead to over-valuation, for the future net earnings are likely to be less than any definite estimate on the basis of past figures. Limited franchises are undesirable to both grantor and grantee, which fact should receive chief consideration in valuing them. If the full going value of the physical property without amortization charges is allowed, the value of the franchise should be greatly reduced. If, on the other hand, the franchise is allowed at its full value on the basis of its earning power in excess of a fair return without amortization charges, the present value of the physical property should be considered in the light of the fact that it will have only scrap value at the expiration of the grant.

H. De F. Baldwin, president and counsel Queens County Water Company, New York; C. A. McLain, lecturer Harvard University, and A. Bettman, attorney-at-law, Cincinnati, Ohio, dwelt on certain legal phases of the question of franchise values. Mr. Baldwin admitted that net earnings were an important element in arriving at the value of a franchise, but that the bare permission to use the streets did not enhance the value of a franchise in the case of a company skillfully managed and thereby enabled to show fair profits. In such a

case the going value of the concern was enhanced and not the franchise. Mr. Bettman claimed that only for determining compensation in condemnation proceedings did a franchise possess a value.

**Land Value, Says Hammond V. Hayes, Is Determined by Finding Both the Original Cost and the Present Cost of the Land in Use.**

The session on Thursday evening, on the subject of land values in valuation work, was presided over by Charles F. Jenkins, proprietor *Farm Journal*, Philadelphia. The order of business covered an address by Hammond V. Hayes, consulting engineer, Boston, Mass., on the subject of the principles to be applied in such work, and discussion thereon. A. E. Helm, J. M. Eschleman, F. W. Stevens and Milo R. Maltbie took part in the discussion which followed Mr. Hayes' paper.

Mr. Hayes said that before any question of the value of land can be considered two figures must be found, one representing the original cost of the land and the other what it would cost to obtain the land now in use and useful, if held in private ownership and acquired by the railroad company at the time of the appraisal. This last figure is the cost of reproduction. An analysis of both the original cost and the cost of reproduction shows that each may be divided into two parts, (1) the figure which would be assigned in condemnation proceedings as the price which a company should pay for the land acquired by it, and (2) the costs of condemnation, of damages and of purchase.

The method which should be employed in ascertaining the first portion of both the original and the reproduction cost is that in which the normal market value is ascertained of adjacent similar lands as revealed by the prices paid in voluntary private sales, both at the time of the original acquisition of the lands by the company and at the time of the appraisal. The normal sales value of adjacent similar property should be found, not for the time of the appraisal alone, but as of the date of the original acquisition of the land under valuation. Moreover, each parcel of land—a parcel being defined as a separate and distinct purchase—should be associated with similar adjacent lands of which the past and present market value can be ascertained. In addition to the two normal basic figures thus found, the amount paid to the original owner of each particular parcel should be found and entered against that parcel. By this method the price paid by the company and the normal market value at the time of purchase are shown for each particular parcel, and there is revealed the difference between the cost to a company of its land and the amount which was paid at that time in voluntary normal sales of similar land. Thus a ratio is established by the use of which the reproduction cost may be found from the normal market value of similar and adjacent land at the time of the appraisal.

In discussing Mr. Hayes' address A. E. Helm, commerce counsel for the Kansas Public Utilities Commission, advocated strongly the theory that public utilities are really public property and the stockholders are only the managers. For these reasons the public cannot allow any private speculation in land values, and the unearned increment becomes a negligible factor. Mr. Eshleman opposed the agency theory. Mr. Stevens brought out the point that under the agency theory the public assumes all of the benefits and none of the risks. He stated that the court conception of value is now what it has always been—present market value. He mentioned the criticism that some railroad property was wrongfully acquired, but he insisted that by digging into the past the public did not restore such property to the original owners, but only wanted to acquire itself what it had never paid for.

Milo R. Maltbie, member of the advisory board, division of valuation, Interstate Commerce Commission, advocated the inclusion of appreciation of land values as an item of income to be credited as such, on the same theory that depreciation is allowed as a charge to operating expenses.

**The Relations of Depreciation to the Determination of a Fair Value Discussed from Engineering and Political-Economy Viewpoints.**

The topic of discussion at Friday morning's session was depreciation. Frederic P. Stearns, consulting engineer, Boston, presided, and two papers by public service commission men were presented.

J. H. Goetz, of counsel for the Public Service Commission, First District, New York, discussed the purport of various court decisions on the subject of depreciation and depreciation accounting.

Halford Erickson, chairman of the Wisconsin Railroad Commission, discussed the "Relation of Depreciation to the Fair Value." He developed the idea of the depreciation fund as a trust fund, holding that renewals must be made out of earnings, that the unfairness of making the consumer of one year pay the entire cost of renewing a long-lived part replaced that year made necessary the setting aside of substantially equal annual installments, and that these installments must be wisely invested to produce the proper amounts at the required time.

Mr. Erickson's own formula for the basis of fair value was cost new minus depreciation (including accrued as well as actual) plus depreciation reserve. If the latter had been dissipated in dividends, it was not entitled to earnings. He thought, however, that no deduction should be made from utilities that had not in the past collected accrued depreciation, as the stockholders had certainly withdrawn nothing from the business.

James E. Allison, consulting engineer, St. Louis, said that there is no depreciation in a composite plant of perpetual life, if properly maintained. What he emphasized especially was the utter unreliability of estimates of expected life and the failure of engineers to bring out this point forcibly. Application of the less-depreciation theory to the unregulated past, he said, meant the implied collection by the utility of a fund to purchase its plant from itself, unwittingly, and devote it to the public. In the past theoretical depreciation was not thought of.

Prof. John Bauer, Cornell University, argued from the agency theory. He held that in some cases capitalization of earnings that should have been made and were not would produce a total fair value on which the utility simply could not make a fair return, while in others the deduction from value of exorbitant past earnings would reduce fair value to nothing or an actual liability; that ever since the case of Munn vs. Illinois was decided the public had had the right to hold the utility to reasonable returns only, and that the investor since then had always assumed the risk that the public would exercise its right—in other words, that he had had his day. Professor Bauer would therefore draw the curtain on the past, forego, in the interests of broad justice, futile attempts at individual justice, and adopt a policy for the future that would be as nearly automatic as possible, holding the utility strictly to a reasonable return.

Mr. Eshleman reminded the conference that inducements must be held out for future capital, with greater compensation for greater risks. Having this in mind, he would not attempt to apply future rules rigidly to the past, but would apply them as far as possible within reason. The investor, he said, was entitled to get his capital back and a fair return, but could only have such

return as the public could supply the service for, otherwise public ownership was inevitable.

**Going Value Discussed by Gen. Morris Schaff of Boston, Clifford Thorne of Iowa, and William J. Hagenah of Chicago.**

Gen. Morris Schaff of the Massachusetts Board of Gas and Electric Light Commissioners, who presided over the Friday afternoon session on "going value," stated in a brief address that the policy of that commission, to allow operating costs, full depreciation, ample and generous profits to good management, and ample allowance for contigencies, resulted in few disputes. He suggested that the financial history of the utility be carefully studied and that distinction be made between competitive and monopolistic properties.

Clifford Thorne, chairman of the Iowa Board of Railroad Commissioners, read the main paper on "going value." He held that value varied according to purpose of its use. Going value, he maintained, consisted of actual development costs and enhancement of value of plant from use since development. He would not allow return on the latter, and to recognize the former he would require proof of early losses not compensated since by excessive returns. In any event he would recognize the deficits of only the first few years.

Mr. Thorne was of the opinion that neither reproduction cost nor original cost should be the sole basis for "fair value," which he conceded is only in the process of being defined. Original cost, he thought, the most effective guide, although reproduction cost may be important.

William J. Hagenah, public utility expert, Chicago, did not agree with Mr. Thorne that only the early experimental stages should figure in going value. He held that with the increasing operating costs of utilities, the declining purchasing power of money and the general extravagance of the last generation, going value was constantly increasing. He cited the municipal utility in the fast growing Western city, constantly compelled to extend its facilities into undeveloped sections and never catching up so as to be in a position to prosper with the community for which it has done so much.

**Courts Will Interfere with Valuations Only in Question of Law or to Prevent Confiscation, says Charles A. Prouty of Interstate Commerce Commission.**

At the dinner Friday evening, which terminated the conference, Charles A. Prouty, director of valuation for the Interstate Commerce Commission, spoke on "The Meaning of the Constitutional Protection in Valuation," defining the functions of the courts.

There is a twilight zone, he said, between the maximum rate, which the legislative body must fix, and the minimum rate, which the courts decide is confiscatory, and in this zone the rate-making power of the commission, the courts have conceded, is supreme. Before the commission can fulfill its duty here it must know the value of the property of which it would fix the rate. The courts will presumably interfere in valuations only in questions of law, or to prevent confiscation where a valuation has been placed in evidence in some suit involving a rate. The court, it is believed, will not set aside valuations simply because the judge is of the opinion that the amount is too small, unless there be palpable or gross error. Hence the welfare of the public utilities is largely under the control of the public service commissioners, and it is of first importance that the utilities and the general public should unite in securing men of the highest grade for the positions and should then inform and support them.

William D. Kerr, attorney, enlarged upon the legal aspects of the constitutional protection in valuation. Newton D. Baker, Mayor of Cleveland, spoke along the agency line of reasoning.

**Prof. John H. Gray of Minnesota Raises Question of Fairness of Expert Opinion Testimony in Public Utility Cases.**

Prof. John H. Gray, University of Minnesota, spoke on "Opinion Testimony." He first reviewed the evolution of the rules of evidence which resulted in the admission of the opinions of scientists if based on facts testified to by others. As applied to valuation, he said the so-called expert testimony of engineers was incompetent; that if value was related to any science it was the science of accounting or economics, but not engineering; that engineers were not trained to a knowledge of wealth or value, and that their expert testimony along these lines was universally regarded by economists as unscientific.

He held that they were not disinterested witnesses, being well paid for their opinions, and hence being in effect assistant counsel testifying. While the main objection to opinion testimony prior to its acceptance in 1800 was held to be the danger of the emotions of man affecting his opinions, Professor Gray thought the present effects of cold calculation more dangerous.

Professor Gray also felt that the public was always at a disadvantage in securing opinion testimony in railroad rate cases, because the railroads could combine and pay more for the testimony, and because eminent engineers feared to testify for the public because of its effect on their futures. Thus courts and juries were likely to be bowled over by the sheer mass of testimony presented.

**Milo R. Maltbie Speaks on the Future of the Public Utility and the Attitude of the Public Toward the Utility.**

Milo R. Maltbie, formerly a member of the New York State Public Service Commission for the first district, who delivered the concluding address before the conference, said that the future of public utilities and the attitude of the public toward utilities under private management will depend in a large measure upon the principles followed in determining fair value. If commissions, legislatures and courts decide that a utility can legally require the public to pay rates sufficiently high to yield a return not only upon the actual investment in the enterprise but also upon property, tangible or intangible, which the public has donated, the public will decide that under such circumstances it would be better to give no donations to the utility, or, if it be necessary, to control and manage the utility itself. If the public must stand all shrinkage in values due to depreciation of property and may not share in gains due to land and other appreciation, but must even pay a return upon such appreciation, all will pause to consider whether private ownership and operation is not so unfair and burdensome that communities cannot afford to allow utilities to get into private hands. Moreover, in regard to depreciation, if it is finally determined that utility property does not thus decrease in value, then it follows that the utilities cannot collect through operating expenses anything for depreciation from the public through rates. In Mr. Maltbie's opinion, however, the utility which opposes proper depreciation funds or uses them, when accumulated, for other purposes, has not only broken faith with the public but invited retaliatory methods which it would be the first to decry. In conclusion, he said that public confidence is one of the greatest assets that any corporation can have, and those who destroy it through their extravagant claims in valuation matters must face an enormous responsibility.

## TEMPERATURE LIMITS FOR INSULATION

### Engineers Discuss Safe Temperatures for Mica-Insulated Windings

Data showing that some of the mica-insulated Niagara Falls generators have been operating at temperatures up to 285 deg. C. for twenty years without injury were presented in a paper read at the New York meeting of the A. I. E. E. on Nov. 12 by F. D. Newbury. The information drew forth considerable discussion in which a number of engineers recommended that the A. I. E. E. standardization rules be revised to allow larger rises in temperature for built-up mica insulation. Some of the more conservative speakers, however, urged maintaining the present allowable temperature limit.

#### Effect on Machine Dimensions and Overload Rating

In a written discussion Philip Torchio of the New York Edison Company called attention to the conditions which resulted in the A. I. E. E. standards committee adopting the present allowable temperature limit of 125 deg. C. for class B insulations. He also referred to temperature guarantees which he had accepted on two 20,000-kva., three-phase generators employed by the United Electric Light & Power Company for supplying single-phase energy to the New York, New Haven & Hartford Railroad. In referring to the data presented by Mr. Newbury, he pointed out that if the temperature obtaining in the Niagara generators were permitted in the United company's machines they would carry continuous single-phase loads of 16,000 kva. and overloads of over 25,000 kva. at 60 per cent power-factor. Mr. Torchio declared that on account of the high speeds required for high steam economy the diameter of rotors must be minimized and the radiation sacrificed so that insulating materials capable of withstanding high temperatures must be employed. Again, turbo-generators for carrying single-phase loads must have large overload capacities at low power-factors. In this case it is doubly necessary that generator dimensions be minimized so as not to sacrifice steam economy, for in an unduly large machine carrying low power-factor overloads iron and field losses are likely to be relatively large. Special guarantees on built-up mica-insulated machines might be allowed, he suggested, but a special protective apparatus should be provided to minimize stresses on the machine in case this is done. In closing, he questioned the value of applying the data obtained from the Niagara machines to higher voltage generators and those machines in which the windings consist of several wires instead of rigid bars.

#### Opinions on Temperature of 150 Deg. C. for Mica

W. J. Foster of the General Electric Company said that the high operating temperatures reported for mica insulation suggest a wide field for its application, especially in generators carrying single-phase loads and in frequency changers. He recommended that the standards committee increase the allowable temperature limit of class B insulation from 125 deg. to 150 deg. C.

H. B. Pope presented a discussion from H. P. Wood of the Edison Electric Illuminating Company of Brooklyn, who said that when the binder of built-up insulation is damaged the mica may be injured by vibration or when cleaning the machine with compressed air. "Service should not be sacrificed to theory," he declared.

H. F. T. Erben of the General Electric Company expressed the belief that it is absolutely safe to permit temperatures up to 150 deg. C. in built-up mica insulation. At high voltages, however, he warned against using shellac or coppel varnish for binders as they will disintegrate at temperatures near 200 deg. C., giving off gases which attack copper and increasing the liability of leakage along the interstices between the mica strippings. The speaker urged keeping temperatures below 170 deg. C. for class B insulation. He expressed the belief that mica and asbestos are required in railway converters, but that in many other cases mica is not necessary and is more expensive.

#### Obstacles to Raising Temperature Limit

C. E. Skinner, Westinghouse Electric & Manufacturing Company, indorsed the plan of raising the temperature limit to 150 deg. C., but called attention to the increase in dielectric losses with increase in temperature. He urged engineers not to be carried away by the Niagara tests since mica is inapplicable in some cases.

J. B. Fisken, Washington Water Power Company, called attention to the displacement and stresses which would be caused by linear expansion if conductors were subjected to high temperatures while the ends were prevented from moving. Intermittent heating and cooling between wide temperature limits may even grind out the mica, he declared.

F. W. Peek, Jr., of the General Electric Company correlated the conditions which will exist if insulations are subjected to high temperatures, pointing out that dielectric strength of insulation and conductivity of conductors will decrease with rise in temperature. Dried-out insulation, he pointed out, may be injured by transient voltages.

W. L. Waters of the Westinghouse Electric & Manufacturing Company pointed out that with high-voltage wire-wound apparatus it is difficult to insulate with mica, owing to the flexibility of the conductors.

In closing the discussion, F. D. Newbury expressed the belief that no suitable binder will withstand more than 175 deg. to 200 deg. C. He declared that windings made of 0.25-in. square wires can be insulated with mica tape and made almost as rigid as solid bar. He expressed the belief that linear expansion can be so compensated that it will not be a limitation to the allowable temperature, but existing data do not warrant raising the temperature limit above 150 deg. C.

Among other members who took part in the discussion of the subject were P. M. Lincoln, L. T. Robinson, Charles F. Scott and B. A. Behrend.

---

## Meeting of Educational Committee of N. E. L. A.

The first meeting of the committee on relations with educational institutions of the National Electric Light Association for the season 1915-16 was held at the offices of the association in New York on Nov. 18, under the chairmanship of John F. Gilchrist. Among those present were Profs. M. C. Beebe, H. E. Clifford, O. J. Ferguson, A. F. Ganz, C. F. Harding, H. H. Norris and G. D. Shepardson, together with W. C. L. Eglin, Paul M. Lincoln, T. C. Martin and S. A. Sewall. Data were presented as to the success of the committee during the past year in securing work for college students during the vacation period in various fields of central-station activity. This work is to be followed up and developed during the coming year along more definite lines with preliminary studies of the work for which each student may be more particularly fitted.

Consideration was given to a number of important questions, particularly the best method of introducing to the students and to the economic classes in colleges and universities the general fundamental principles of public utility enterprises and the problems which the central station is seeking to solve in regard to its relations with public service regulating bodies, the public itself, the employee in welfare work, and, last but not least, the investor upon whom rests in the end the burden of providing funds for public utility development.

## Engineers' Club of Philadelphia Adds 1576 New Members in Four and a Half Days

On Friday, Nov. 12, the Engineers' Club of Philadelphia brought to a close a membership campaign which added 1576 new names to the roster in four and a half days, bringing the total membership of the club to 2127 and making it the largest local engineering club or society in the country. Since the close of the campaign 236 additional applications have been received, bringing the total membership of the club to 2363. The roster of the club at the beginning of the campaign showed a total membership of 551, while accessions for the last fiscal year numbered only thirty-six.

The campaign forms the climax of a movement which started in the club in 1913, when it was proposed that all the local branches of national engineering societies become affiliated with the club and make use of the club's facilities for their meetings. This plan was consummated early this year. Under it the Philadelphia sections of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the Alumni Association of the Massachusetts Institute of Technology have become affiliated organizations. Their members are entitled to attend the meetings of their organizations in the club house and to enjoy the privileges of the club on the afternoons and evenings of the meetings. For these privileges the local branches pay annually $1.50 for each of their members.

The membership campaign organization consisted of twenty-eight teams of five men each, the captains being selected for their wide acquaintance and their energy. These twenty-eight teams were then divided into two divisions, the main contest being between these larger groups. Richard L. Humphrey, consulting engineer, was placed in charge of the first division, and S. M. Swaab, chief engineer of the Keystone State Construction Company, in charge of the second division. D. Robert Yarnall was in general charge of the details of the campaign, while Dr. Edgar Marburg, professor of civil engineering, University of Pennsylvania, acted as general chairman of the campaign membership committee.

## Hydroelectric Enterprises in Italy

BY LUDWIG W. SCHMIDT

Electrical energy will have a large part in the future industrial development of Italy. The country is poor in coal and depends practically entirely upon England or Germany for the fuel used in its industry. During the last years it has imported coal at the rate of about 10,000,000 tons a year, the rate of import having increased about tenfold since 1880. The use of electrical energy may become imperative for Italy, especially as the country has exceptionally favorable conditions for the foundation of hydroelectric enterprises. Some time ago a beginning was made and to-day the north of Italy is full of hydroelectric stations supplying a large percentage of the energy demanded, while the government has authorized the foundation of others. The largest of the plants are those of Paderno d'Adda, supplying 14,000 hp.; of Vizzola, supplying 20,000 hp.; of Valcamonica and Tirano, with the same production; of Terni, with 30,000 hp.; Grosseto, with 32,000 hp., and Bussi, with 43,000 hp.

According to official Italian statistics, permission has been granted for the erection of hydroelectric plants in 3056 cases, securing the supplying of nearly 1,000,000 hp. of energy. The provinces of Umbria, Lombardy and Piedmont are the most prominent districts for the erection of hydroelectric plants. The peculiar geographic formation of the country allows the erection of many small plants for the use of smaller villages and industrial enterprises. There are authorized for erection in Tuscany 239 plants, producing only 11,106 hp. The north has many such smaller enterprises. In the province of Abruzzi and in Sicily 301 concessions have been given for the production of 5594 hp. Although hydroelectric enterprises are still young in Italy, they will play a large part in the future industrial life of the country. The energy now available for industrial use has been estimated at 5,500,000 hp.

## American Electrical Apparatus for Russia

With the conclusion of the war in Europe electrical apparatus of American manufacture will be greatly in demand in Russia, according to a statement made by Nicolai Fedotoff, electrical engineer for the Petrograd branch of the Siemens-Schuckert company, to a representative of the ELECTRICAL WORLD.

Mr. Fedotoff has just arrived in the United States from Petrograd and expects to make a study of the manufacture of telephone material with the intention of placing here a large order.

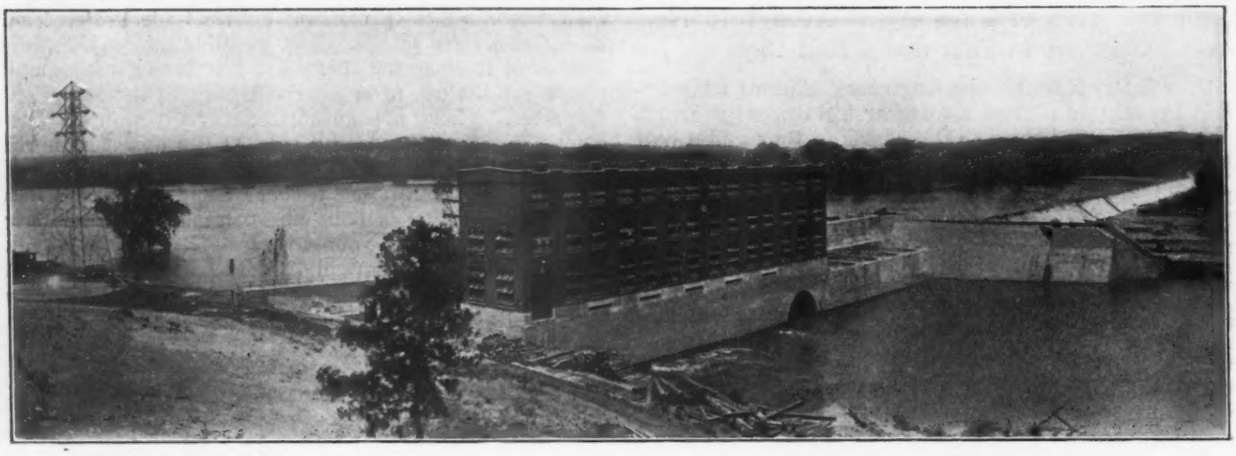
Electricity is now widely used in Russia, he stated, and when the war is over the necessity for the rehabilitation of the empire's industries and the large demand that will be made on them for the reconstruction of the war-swept areas will create a tremendous demand for generators, motors, line equipment, and all of the other electrical equipment which is needed for industrial installations.

A further point brought out by Mr. Fedotoff in this connection was that American and English technical men of sound training would be needed by Russia. The war has taken many of her engineers, and when the period of reconstruction begins their ranks will be found to be seriously depleted. For this reason Russia will offer a brilliant opportunity to engineers who have received their training in England or the United States.

## Foreign Business of the Swiss Electrical Industry for 1914 Compared with Preceding Year

The war has effected great changes in the foreign business of Swiss electrical manufacturers. Not only have the imports undergone great reductions in quantity and value, but the exports as well are considerably less than for the preceding year. The figures reported below are for the year 1914, and consequently include only half of the first six months of the European war. According to figures received the following changes have taken place:

| | Imports | | Exports | |
|---|---|---|---|---|
| | 1914 | 1913 | 1914 | 1913 |
| Dynamos | $275,000 | $308,600 | $3,115,600 | $4,070,600 |
| Batteries | 66,200 | 85,800 | 17,200 | 23,000 |
| Meters | 200,400 | 214,200 | 407,400 | 461,400 |
| Instruments | 378,400 | 475,000 | 748,000 | 999,200 |
| Telephone and telegraph apparatus | 242,400 | 174,400 | 21,400 | 30,000 |
| Arc lamps | 5,600 | 26,400 | 400 | 1,000 |
| Incandescent lamps | 309,000 | 427,000 | 115,600 | 178,200 |
| Cables | 141,600 | 139,600 | 194,800 | 280,600 |
| Copper wire | 1,440,800 | 2,074,000 | 380,800 | 560,400 |
| Porcelain insulators | 210,400 | 302,800 | 7,800 | 4,800 |
| Carbons | 52,800 | 60,000 | 38,800 | 28,600 |
| Electrodes | 156,400 | 204,000 | 22,400 | 22,400 |
| Machine parts of all kinds weighing over 100 lb. | 488,400 | 809,200 | 36,600 | 29,600 |
| Machine parts of all kinds weighing less than 100 lb. | 49,800 | 68,800 | 1,200 | 1,800 |



# A Hydroelectric Plant on the Savannah River

**A 13,000-Kva. Plant of Georgia-Carolina Power Company Connected with a Steam Generating Station at Augusta, Ga., and a 44,000-Volt Transmission Line**

NINE miles above Augusta, Ga., on the Savannah River, at the mouth of Stevens Creek, a 13,500-kva. hydroelectric plant has been constructed from which energy is transmitted at 44,000 volts to a substation at Augusta, Ga. This station is tied in with a 4000-kva. hydro-steam plant at Augusta and a 25-mile transmission line extending to Clearwater and Aiken, S. C. All of the energy is supplied to the Augusta-Aiken Railway & Electric Corporation, which in turn sells part for industrial power and lighting purposes. Sufficient water-power is available in the Savannah River at the plant site to develop 31,250 hp., so the wheel pits have been constructed with this ultimate development in view. The additional 15,625 hp. in equipment will not be installed until the market for electrical energy warrants it.

The dam, which is of solid cyclopean concrete 2700 ft. long and 30 ft. above bedrock, on the average, impounds water for 13 miles upstream and provides a 27-ft. head normally. An additional head of 4 ft. can be obtained with flashboards. The spillway, which has an ogee contour and is 2000 ft. long, is designed to discharge 450,000 cu. ft. of water per second. With this discharge rate the maximum depth over the spillway is 14 ft. 6 in. Built in the dam are five 8-ft. by 8-ft. sluicegates, each of which will carry off 2000 cu. ft. of water per second. Between the spillway and the power house, which is on the Georgia side of the river, are 30-ft. by 150-ft. navigation locks. The gates for filling and emptying the locks, as well as the sluicegates, are operated by hand at the present time, but provisions are made for motor operation.

### Generators and Single-Runner Turbines

The power-house substructure will accommodate ten generators in two groups, between which are the ex-

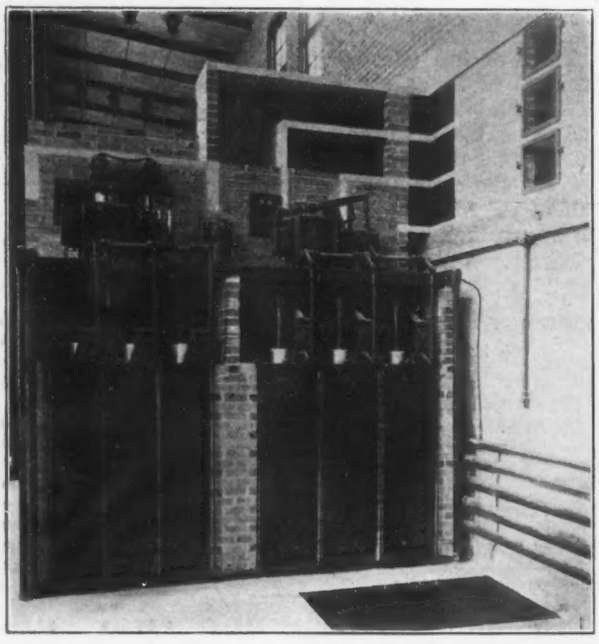


FIG. 1—OIL SWITCHES AND TRANSFER BUS SERVING ONE PAIR OF GENERATORS

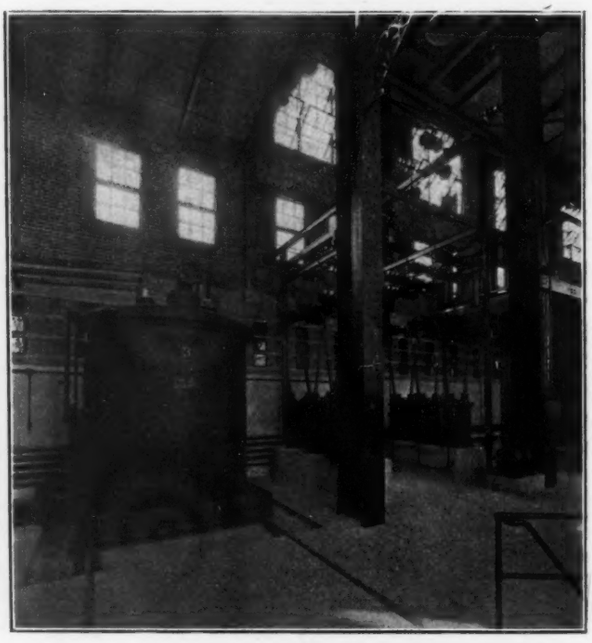


FIG. 2—WATER-COOLED 5400-KVA. TRANSFORMER AND HIGH-TENSION OIL SWITCHES

citers and main switchboard. Only the five generators nearest the shore and the exciters have been installed so far, with their protecting superstructure. The remainder of the electrical equipment, including transformers, main buses and oil switches, is installed in a bay extending along the up-stream side of the power house. Rheostats, control-circuit battery, station auxiliary bus and transformers and one lightning arrester are situated on a gallery back of the switchboard. Each of the three transformers provided is capable of caring for the energy delivered by two generators. A 50-ton motor-operated crane runs over the main floor. Anchor rings in the wall and floor enable this crane to be used in moving the transformers.

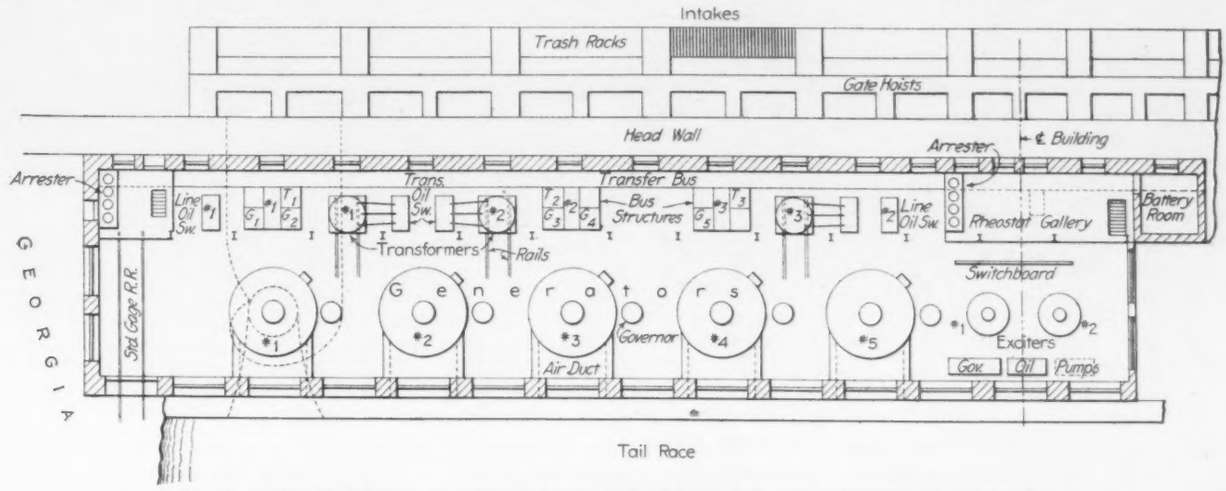


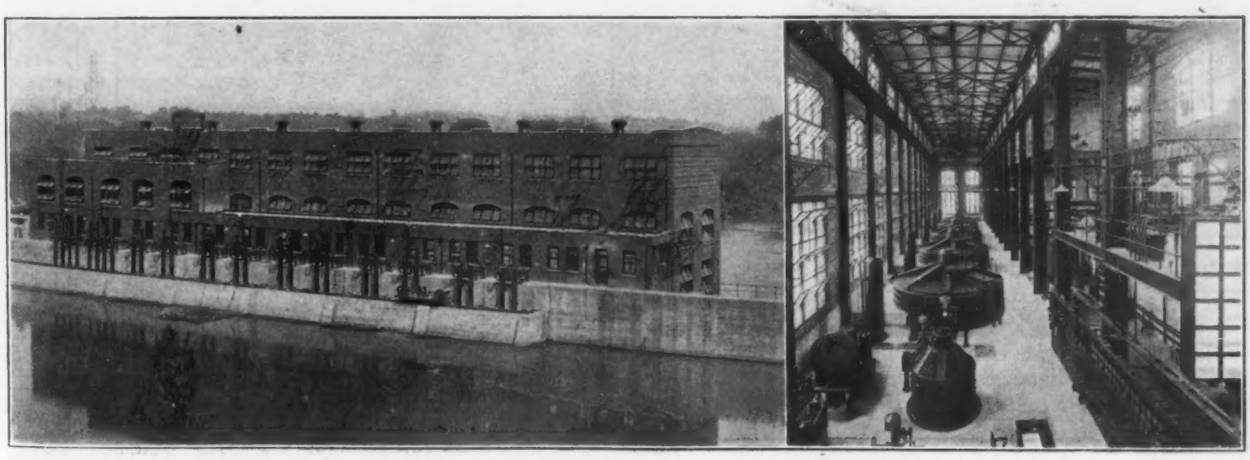

FIG. 3—ARRANGEMENT OF GENERATING, TRANSFORMING AND SWITCHING EQUIPMENT

Generator switches $G_1$, $G_2$, $G_3$, $G_4$ and $G_5$ and transformer switches $T_1$, $T_2$ and $T_3$ are arranged in groups so that each transformer can serve two generators. As shown in this drawing and Fig. 1 the 2300-volt transformer switch for each group is next to the wall on the side nearest its respective transformer and connected with its terminals by open-work busbars. The 2300-volt transfer bus, however, is run through cells in the up-stream wall as indicated in the plan and Fig. 7. The 44,000-volt transformer switches are also connected with their respective units with open-work busbars. With this arrangement very short busbars and relatively little duct construction were necessary.

The prime movers are I. P. Morris Francis-type, vertical-shaft, single-runner turbines rated at 3125 hp. and 75 r.p.m. with a head of 27 ft. Each is directly connected with a three-phase, 2300-volt, sixty-cycle, 2700-kva. (maximum) Westinghouse generator. The turbines have guaranteed efficiencies of 84 per cent at full load, 86 per cent at 2950 hp., 81 per cent at three-quarters load, and 72 per cent at half load. With full load and 75 per cent power-factor the generators are guaranteed not to increase more than 50 deg. C. in temperature after twenty-four hours' operation.

The efficiencies of the generators with 75 per cent power-factor are 92.6 per cent at full load, 92 per cent at three-quarters load, 90.6 per cent at half load, and 85 per cent at quarter load. Full-load regulation with 100 per cent power-factor is 12 per cent; with 75 per cent power-factor it is 30 per cent. Each unit requires 60 kw. of exciting energy at 250 volts and 100 per cent over-speed. The flywheel effect of each rotor is about 3,000,000 ft.-lb., so that fluctuations in load are cared for without taxing the governor mechanism.

The total weight of the revolving parts of each turbine and generator is carried by a Kingsbury thrust bearing which is supported by a six-arm spider bracket forming the upper part of the generator. The oil in this bearing is circulated through a cooling reservoir below the bracket. In case the circulation is interrupted an automatic alarm system rings a bell at the switchboard and lights a red lamp over the bearing needing attention. Cooling air for the generators is drawn into the bases through air ducts which are connected with openings in the down-stream wall of the building. The speed of each turbine is regulated by a floating-lever governor which controls the movements of the guide vanes through an oil pressure system. The oil is drawn from individual reservoirs and maintained under a pressure of 125 lb. to 150 lb. by two induction-motor-driven triplex pumps. The air above the oil in the reservoirs is maintained under pressure by water-cooled air compressors.



FIGS. 4 AND 5—HEADGATES AND OUTGOING TRANSMISSION LINES, AND INTERIOR OF STATION

The exciters are also directly connected with single-runner vertical-shaft turbines. These are rated at 450 hp. and 200 r.p.m. with 27-ft. head. At full load they have a guaranteed efficiency of 82 per cent, at 420 hp. of 83 per cent, and at half load of 71 per cent. The exciters are compound-wound and equipped with balance

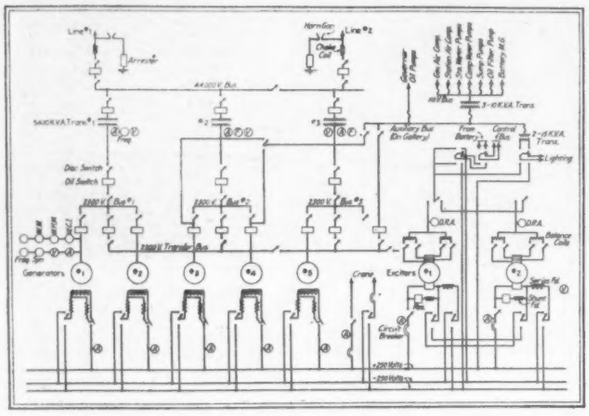


FIG. 6—EXCITER, TRANSFER AND HIGH-TENSION BUS ARRANGEMENTS IN STEVENS CREEK STATION

coils which provide a neutral for a 125-250-volt three-wire system. The temperature of these units, except for the commutators, will not rise more than 50 deg. C. after carrying full load for twenty-four hours. Commutator temperature rise is limited to 55 deg. C. The guaranteed efficiencies for the exciters are 91.2 per cent at 1.25 load, 92 per cent at full load, 92.2 at three-quarters load, and 91.5 per cent at half load. The 125-volt circuits are used only for emergency lighting and control. The exciter governors are connected with the turbine shafts and not with the central oil system of the main generators.

All 2300-volt busbars consist of copper bars set in buff brick structures. The 2300-volt oil switches are arranged in groups opposite each pair of generators (see plan), two units of each group being generator switches, a third a transfer-bus switch, and a fourth a transformer switch. Next to each group is a transformer with its 44,000-volt switches. The transfer-bus and transformer switches are designed to carry the load of two generators. The generators are connected with their corresponding busbars by two 500,000-circ. mil lead-covered cables per phase, the cables being run in 2-in. fiber conduits.

Three 5400-kva. (maximum), three-phase, 2300/44,000-volt water-cooled, delta-delta transformers are provided. Under full load and with 50 gal. of cooling water per minute they are guaranteed not to rise in temperature more than 50 deg. C. above the temperature of the entering water. At full load the units have an efficiency of 98.45 per cent, at half load 98.4 per cent, and at quarter load 97.6 per cent. The regulation with full load is 1.2 per cent at 100 per cent power-factor and 4.6 per cent when the plant is operating at 75 per cent power-factor.

### Cooling Water for Transformers

Cooling water for the transformers is pumped from the river. As this contains considerable silt, the water is pumped first to a settling basin and then through a filter to a reservoir. On the hillside outside the station is a 40-ft. (diameter) concrete-lined cooling pond equipped with five spray heads for cooling the transformer water. The level of this pond is kept constant by means of a float valve on the intake line coming from the reservoir. Two induction motor-driven, single-suction centrifugal pumps circulate the water through the transformers and pond.

Piping extends along the head-wall of the station and connects all high-tension oil switches and transformers with oil-filtering equipment and a reservoir so that oil can be circulated through the filter or discharged into the reservoir for future use. Pipe taps are also provided so that oil can be delivered to or discharged from the lightning-arrester and low-tension oil-switch tanks.

All energy for the control of oil switches, governor motors, rheostats, etc., is furnished by a 55-cell storage battery capable of discharging 20 amp. for eight hours. The battery is situated on the gallery behind and above the main switchboard. A 5-kw. motor generator set is used for charging the battery. An emergency lighting circuit is automatically connected with the battery by a no-voltage relay when the station lighting bus is de-energized. Energy for operating station auxiliaries and lamps is furnished by three 10-kva., single-phase power transformers and two 15-kva., single-phase lighting transformers. The high-tension windings of these transformers are energized from a 2300-volt bus. Emergency connections, however, can be made directly with No. 3 or No. 4 generator.

Supported on the head-wall of the station where it can be connected with all apparatus, such as oil-switch pots, frames, transformer cases, switchboards, etc., is a No. 0 stranded-copper ground bus cable. It is connected with the main steel work of the building in a number of places and also with the trash racks at the intake. Separate grounds are provided for the arresters.

Non-automatic type E oil switches are employed between the 2300-volt busbars and the generators and transfer bus. In the circuits between the 2300-volt bus and the transformers are automatic type C switches. All 44,000-volt switches are Westinghouse type GA automatic. The 44,000-volt busbars consist of bar and 0.75-in. tubing attached to pin-type insulators suspended from the roof purlins. Where the conductors

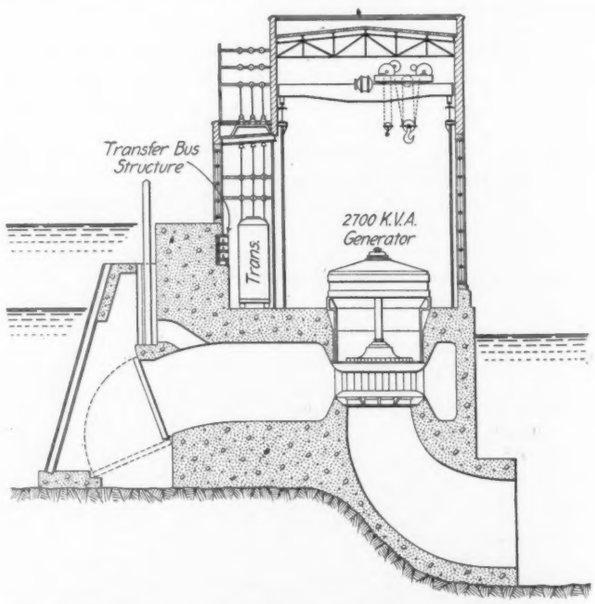
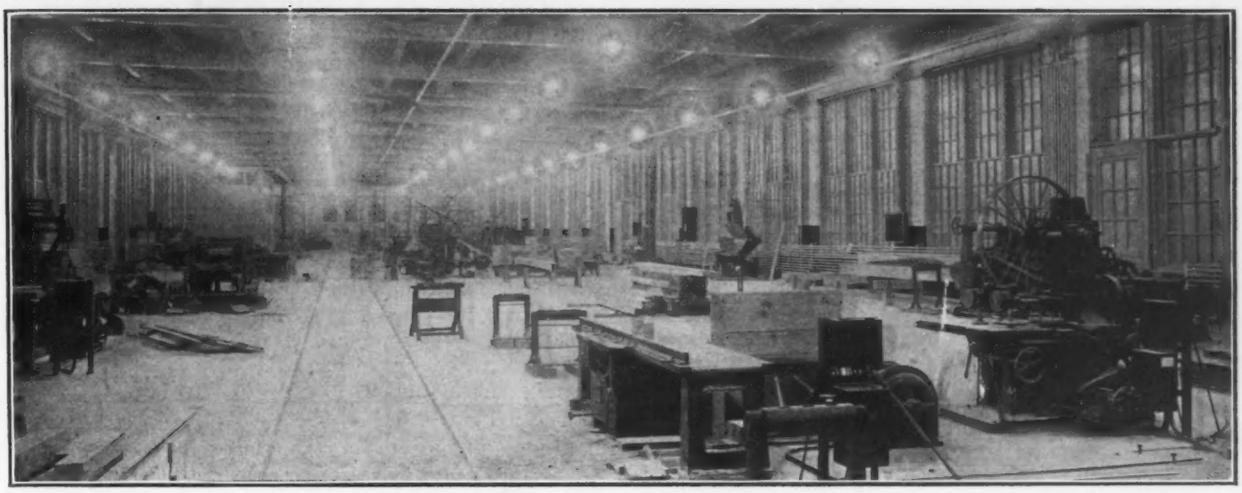



FIG. 7—SINGLE-RUNNER TURBINE OPERATING UNDER 27-FT. NORMAL AND 31-FT. MAXIMUM HEAD

pass through the walls and roof Ohio Brass No. 10,655 bushings are employed.

This plant is operated by the Georgia-Carolina Power Company, was designed and constructed by the J. G. White Engineering Corporation, New York, and is managed by the J. G. White Management Corporation.



The photograph of the lighting in the planing mill shown above is one of a group of sixteen illustrations taken from the code recently issued by the Illuminating Engineering Society and forming a part of the explanatory notes. Advantages of good light to the user are summarized in the code as: (1) Reduction of accidents, (2) greater accuracy in workmanship, (3) increased production for the same labor cost, (4) less eye strain, (5) better working and living conditions, (6) increased contentment among workmen, (7) more order and neatness in the plant, (8) supervision of men made easier.

# A Code for Better Industrial Lighting

BY C. E. CLEWELL

ENGINEERS, central-station executives, public commissioners, salesmen of lighting service, and factory managers all will find the Code of Lighting recently issued by the Illuminating Engineering Society a most practical summary of information about factory illumination. This review cannot present more than a broad outline of the work of the committee, of which Mr. Clewell was chairman. There is much practical material for the user in the report, and this information should be distributed for the mutual benefit of the user and the industry.—*Editor's note.*

Because of the lack of generally recognized standards for industrial lighting work, a recital of the method of preparing the recently issued Code of Lighting of the Illuminating Engineering Society and a description of its main features may be interesting.

The code is divided into three parts. One of these at the outset defines in eleven brief articles the recommendations for legal enactment, a second outlines a number of pointed rules to guide in the accomplishment of successful results, and a third is devoted to a liberal discussion of the fundamentals of illuminating engineering under the sub-title "Explanatory Notes." Several of the articles pertinent to mandatory requirements merit special attention.

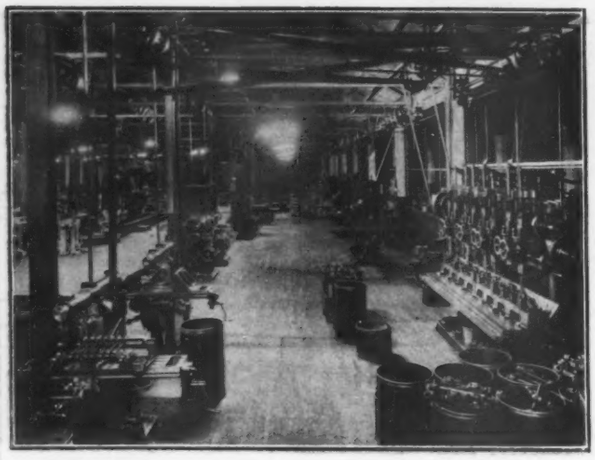
These articles have been developed on a basis of the illumination intensity in foot-candles required for a number of different classes of work. For example, in one of the articles four main divisions of industrial work are classified, roughly covering the extremes likely to be found in practice, and the minimum and desirable intensities of illumination are listed according to these divisions. In this respect the code is a departure from previous attempts at legislation, in which the candle-power per square foot has in certain cases been a favorite method of specifying illumination quantitatively.

### Factory Illumination an Engineering Problem

To offset the limitations which must naturally be set up in the minds of those interested in using the code, owing to such a brief classification of factory work, there will be found under the explanatory notes a sub-section recommending strongly that expert assistance be secured in such cases; that is, the help of individuals who possess the qualifications to enable them to place any given class of work in its proper division when uncertainties arise. This attitude involves the definite policy of looking upon factory lighting as distinctly an engineering proposition and as being most acceptably designed and installed under the general supervision of those specially trained to handle such work intelligently.

Following out these same general lines of procedure, the daylight requirements are based on similar outlines, these being referred to the corresponding requirements of artificial light, which are in turn used as the starting point. Throughout the code careful attention is devoted to daylight, and, appreciating the lack of information relating to the design of windows and other items, ample space has been given to window glasses and calculations of window openings to produce certain results.

Probably no phase of lighting practice, however, has received greater care in the preparation of this document than that relating to accident prevention. The articles at the outset define the lighting of passageways and places not usually frequented, placing strong emphasis on the consideration of safety, and a complete article is set aside for the recommendation of auxiliary lamps in addition to the main lighting system in all large work spaces. Attention is called to the fact that this is a safety-first precaution which is insisted upon in a large proportion of the thousand or more buildings coming under the control of the Bureau of Water Supply, Gas and Electricity in New York City, particularly



MERCURY-VAPOR ILLUMINATION IN A FACTORY

This photograph is presented in the code as an illustration of mercury-vapor lighting in a low factory section. The lamps are about 12 ft. above the work. The code calls attention to two considerations in determining for or against high-candle-power lamps for the factory or mill—first, how the lamps can be mounted, and, second, whether the light in order to be most suitable at the machines should come from a few or many sources.

such buildings as are occupied by large numbers of people.

As a guide to inspectors and others, the intensity requirements are supplemented by an explanatory clause which states that roughly 1 cp. per square foot produces an effective illumination of 3 ft.-candles when the lamps are arranged according to the uniformly distributed overhead system, with mounting heights ranging from 12 ft. to 16 ft. above the floor, and when the light is directed from these lamps to the work in an efficient manner. This is included to aid those who may not be familiar with the technical meaning of the units of illumination intensity to check up a system in a rough manner so as to ascertain whether the requirements are being met. For example, if the intensity specified for a given class of work is 4.5 ft.-candles on a plane passing through the work, it is necessary merely to take one-third of this value, giving as a result 1.5 as the approximate candle-power per square foot which must be provided to meet the intensity requirements.

As a safeguard, however, to the proper use of this method, the recommendation is made that a portable photometer or illuminometer always be employed for the determination of intensities in existing systems, particularly in uncertain cases. Along with these items relating to intensity, emphasis is placed upon the proper illumination of the sides of the work. Adequate light intensity is stipulated both on a vertical plane and on a horizontal plane passing through the work, and in those cases where operations are performed on the sides of the work in hand the plan is to have them classified in the same manner as that adopted for vertically downward intensities, the latter being made the basis for the reference table. Where the illumination is furnished from lamps overhead, the modified conditions, in contrast to those involved with individual lamps, cause the statement to be included that in the classification of sides of work the illumination must preferably be not less than 50 per cent of the values specified for a horizontal plane through the work. These recommendations are based almost altogether on practical experiences under well-designed lighting systems.

### The Explanatory Rules and Notes

That portion of the code not included under the mandatory requirements is devoted to such explanatory rules and other notes as have been considered of particular value to the practical side of this work. The rules are covered in eight brief statements or suggestions, among which may be mentioned the use of reflectors for minimizing glare and economizing light, the advantage of mounting lamps high and out of the ordinary line of vision, features of lamp control, maintenance, and the importance of keeping walls and ceilings clean and light in color.

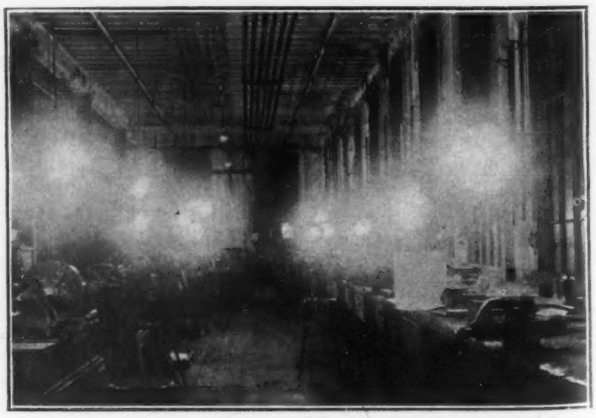
In no portion of the explanatory notes has greater emphasis been placed on a topic than under the head of the value of adequate illumination to the industries. The committees responsible for these notes have realized the appeal which the economic side of this question makes to the average factory manager, and considerable space has therefore been given to this discussion. Practically all the major points in this connection which have been developed during late years with the increasing attention paid to better shop lighting have been compiled into a carefully prepared list of items, typified by "accident reduction," "greater accuracy in workmanship," "increased production," and other similar factors.

With all the work that has been done along this special line, however, difficulties are still experienced in convincing the factory manager that there is a tangible return from better lighting, and the portion of the notes just referred to is therefore supplemented by a paragraph on the proper interpretation of these advantages of good light. While the launching of such a code has within its scope wide possibilities as a helpful influence in future legislation, it is believed that with such methods of treatment it can be almost equally useful as a guide to those who have been more or less ignorant of the improvements which have become available during the past few years.

From the commercial standpoint there has been a concerted effort to draft every phase of the material so as to be adapted both to gas and electric lighting. Thus, when dealing with lighting circuits for electric lamps supply mains for gas lamps are included under the same division; furthermore, methods of switching and control are adapted to either class of service. As a general proposition, the explanatory notes throughout tend to amplify the articles of a mandatory nature, and these require no additional mention at this juncture.

### Guarding Vision

Two points, however, deserve brief mention, because they are not so related to the mandatory paragraphs. One of these relates to features of eye protection other than those affected by lighting. It is urged that those responsible for the health and welfare of employees shall see that adequate protection is afforded the eyes



GLARE FROM BARE TUNGSTEN LAMPS

Excessively bad lighting is illustrated above and should be compared with the illustration of good illumination in the same shop reproduced on the opposite page. Bare lamps, which are here pictured, are still to be found in hundreds of establishments in spite of the increased knowledge of the harmful effects of glare.

in all operations which might be apt to cause injury if protection is neglected. As a typical instance arc welding is mentioned, where the ordinary helmet is used to protect the eyes as well as the head and face of the operator. The protective glasses for eye protection in such cases should not be judged as to their protective properties by mere visual inspection, and it is strongly urged that they be analyzed for their spectral transmission of invisible radiation, which might prove permanently injurious to the eyes, while at the same time the operator might not ordinarily be cognizant of its presence.

The other point relates to the method of illustration. As a general rule, photographs have been resorted to, in order to bring out the varied features of good and bad lighting. In the use of such views the captions have been designed carefully so that the reader may easily detect the points of importance. A few diagrams have been employed to illustrate certain specific features of illumination design, but the use of diagrams has been limited in favor of the photographic views.

### Objects and Probable Use of the Code

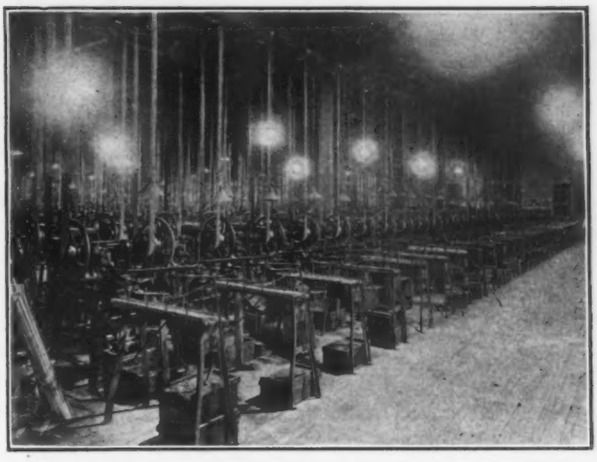
As an index of the intent of the two committees which have drafted this new code it may be stated that the primary object has been to provide in convenient and unbiased form authoritative information for bodies, typified by the public service commission or the factory board, which are likely to manifest a growing interest in enactments, or at least rules and regulations, governing better lighting.

A brief reference to the code articles will demonstrate that they are not couched in legal terms but are rather in simple and easily understood language. The committees have felt that in this manner industrial commissions and other groups in States or municipalities which shall actively take up the questions of legislation as related to factory lighting may readily transfer this method of treatment into legal form, while at the same time the industries themselves have available immediately in practical form a working guide or modified handbook for the conduct of their own work.

In this connection reference is merited to one feature of the marked changes which have been wrought in the factory-lighting field, namely, the underlying causes which have been responsible for much of the work accomplished during the past five years. This is referred to at this point since it will indicate clearly the reasoning of the committees and the basis for their decision to place the code in more or less popular form.

THE SAME SHOP WITH REFLECTOR UNITS

This photograph should be compared with the illustration opposite. In the photograph above, tungsten lamps with metal reflectors furnish the detail illumination over machines and benches. The row of lamps near the ceiling permits of good general illumination.



LIGHTING A LOW SECTION WITH 250-WATT UNITS

Here a rather low factory section is lighted by 250-watt tungsten lamps mounted 12 ft. above the floor. The original lamps over the machines are still in evidence. The code makes practical recommendations in regard to separate circuits for lighting, control and arrangement of switches, reflectors, lamp location and maintenance.

### Influences Directing Attention to Good Lighting

It has been apparent to many observers that the growing attention to factory and mill lighting has been due to something other than legislation in many States where such legislation does not exist. It has further been felt that the chief of these influences might be listed as follows:

(a) The awakening of the industries to the actual economic value of good light in their operation and general supervision of men and machinery.

(b) Public opinion through the technical and popular press has had some bearing on the marked interest among employers and factory owners in the betterment of factory environment, which has included lighting along with other items.

(c) Compensation laws have caused widespread attention to methods of accident prevention, among which has been placed suitable light.

Finally, in those States where legislation has been enacted concerning the requirements of minimum illumination under factory surroundings, legal aspects have been given to the situation.

It is hardly necessary to point to the many factories in those States not possessing lighting legislation thus far where the standards of illumination are considerably higher than is the case in the legal requirements in those States that do have such laws in order to bear out the contention that influences other than legislation have thus far been responsible for much of the excellent work accomplished in the field of factory lighting. Granting that this is true, it seems to follow logically that a code prepared fundamentally for legal enactment will not serve so wide a circle as one in which the legal articles are supplemented by liberal explanatory notes and sufficient general information to make the average reader feel able to grasp the meaning of the various points at issue.

Following out this general line of reasoning, the committees have felt at liberty to amplify such portions of the treatment as might not readily be understood by the poorly informed to a somewhat greater length than might have been looked upon as advisable had the code been intended solely for legislative use. It is reasonable to believe that with this liberal intent on the part of the committees and of the society as a whole a practical working document of this kind will have a generous circulation and that it will fit in very well with much industrial lighting work in the near future.

# Synchronous Motors for Power-Factor Correction

## Effects of Low Power-Factor on Generators and Transmission Systems—Corrective Benefits of Synchronous Condensers and Motors—Curves That Aid in Determining Required Correction

BY TH. SCHOU

IN view of the fact that in most articles treating of synchronous motors the tendency has been either to give actual statistics of their use or to go into the technical features too elaborately for the average engineer to follow, the present writer believes it desirable to discuss the practical engineering problems involved, the disadvantages of low power-factor, both to generators and system, and the benefits that may be derived from the use of synchronous motors as a corrective agency. In the first part of what follows will be explained, in as non-technical a manner as is consistent with the subject, the electrical characteristics of a typical alternator and the detrimental effect of a low operating power-factor on the system as a whole. The remainder of the article will illustrate the practicability of the synchronous motor as a power-factor corrector and discuss several curves for everyday use. This subject is primarily one of power-plant economics. Where plants at present are being worked at low power-factor to their maximum overload capacity a careful study will help to improve economy of operation.

### Alternator Characteristics

The "magnetic characteristic" or saturation curve for an alternator (Fig. 1) shows at different voltages the amount of field amperes or field ampere turns necessary to magnetize the air-gap and the iron of the machine. The saturation characteristic for the air-gap alone is, of course, a straight line. The characteristic for iron, however, is a curve, being nearly straight at lower and bending more and more at higher magnetic densities. Referring to Fig. 1, it will be seen that at normal voltage (240 volts) a current of 8.6 amp. is required to magnetize the air-gap and 2.5 field amp. to magnetize the iron of the generator. The total field amperage necessary to magnetize the machine at no-load normal voltage, therefore, is $8.6 + 2.5 = 11.1$. In Fig. 1 a tangent to

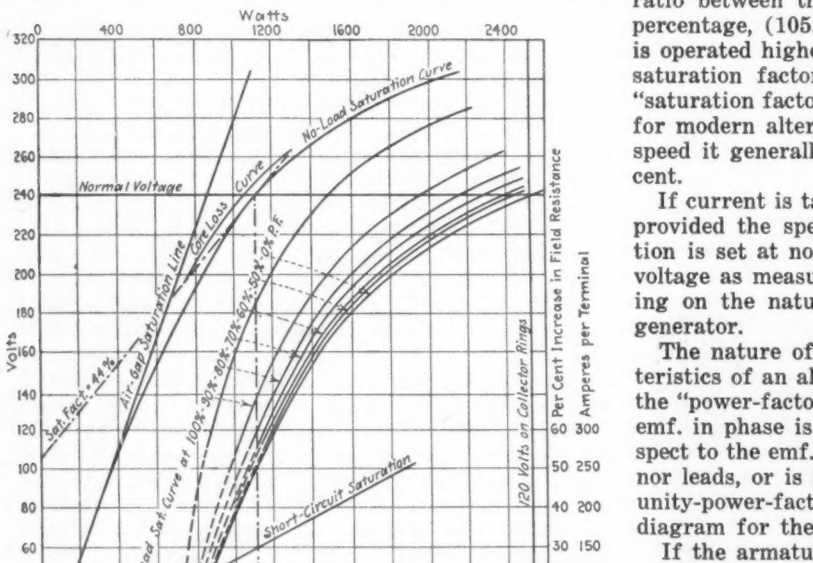



FIG. 1—TEST DATA FOR A STEAM-ENGINE-DRIVEN ALTERNATING-CURRENT GENERATOR

Normal rating: 40 kva., 240 volts, 96.5 amp., three-phase, Y-connected, sixty-cycle, 300 r.p.m. Resistance: Phase 1-2, 0.1070 ohm; phase 2-3, 0.1069 ohm; phase 1-3, 0.1071 ohm. Field, 3.96 ohms.

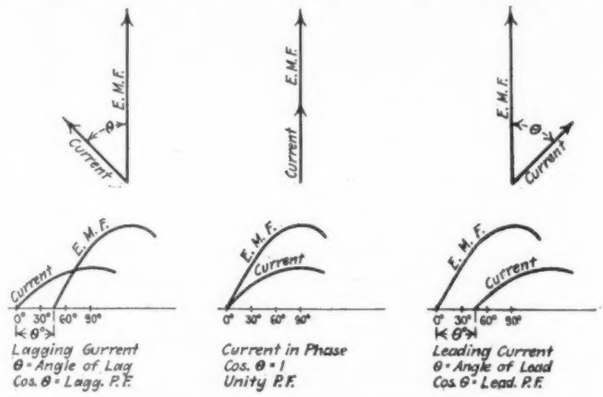



FIG. 2—VECTOR RELATIONS FOR LAGGING, IN PHASE AND LEADING CONDITIONS IN A CIRCUIT

the magnetization curve is drawn at normal voltage point. This tangent cuts the voltage axis at point $P$, or at 105.5 volts. The so-called "saturation factor" is the ratio between this voltage and normal voltage, or, in percentage, $(105.5 \div 240) \times 100 = 44$. As the machine is operated higher or lower on the saturation curve the saturation factor will rise or fall. The value of the "saturation factor" may change according to design, but for modern alternating-current generators of moderate speed it generally lies between 30 per cent and 50 per cent.

If current is taken from the armature leads, we have, provided the speed remains the same and field excitation is set at no-load normal voltage, a drop or rise in voltage as measured at the armature terminals depending on the nature of the load and the design of the generator.

The nature of the load, besides the inherent characteristics of an alternating-current generator, introduces the "power-factor," which if the current lags behind the emf. in phase is lagging and if it leads in phase in respect to the emf. is leading. If the current neither lags nor leads, or is in phase with the emf., there is then a unity-power-factor condition. Fig. 2 gives the vector diagram for the three above conditions.

If the armature leads are short-circuited through an ammeter and the generator is driven at synchronous speed, the short-circuit saturation may be plotted with terminal amperes per phase and field current. The field current $I_s$ corresponds to full-load amperes per terminal and is the field current necessary to overcome the armature reaction. At full-load 0 per cent lagging power-factor the ratio $I_o \div I_s$ is termed the normal short-circuit ratio. In Fig. 1 load curves at different lagging power-factors are shown.

With field excitation set at no-load normal voltage or $I_o = 11.1$ amp., the voltage would drop for the different

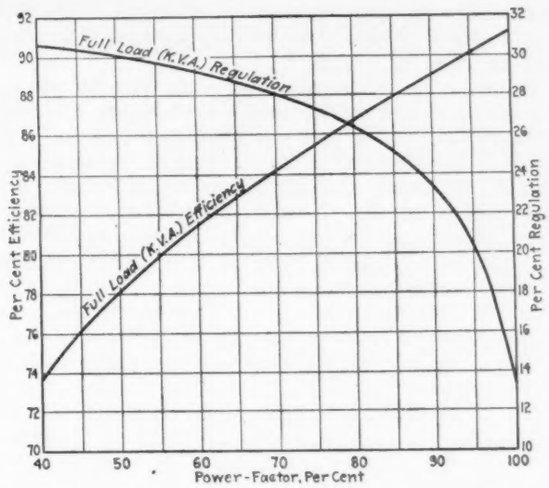



FIG. 3—FULL-LOAD REGULATION AND EFFICIENCY CURVES AT VARIOUS POWER-FACTORS FOR ALTERNATOR IN FIG. 1

power-factors at full load according to the values shown at the points where the vertical at 11.1 amp. cuts the full-load saturation curves as plotted. In order to maintain normal voltage of 240 or normal kva. output, the field excitation must be increased according to the values shown where the horizontal line at normal voltage of 240 cuts the full-load saturation curves.

**Magnetizing Effect of Leading Current on Alternator Field**

In general, the load a generator must carry at the different power-factors is inductive, as an induction-motor load, arc lamps, transformers, and the like, and such load introduces lagging current. This lagging current demagnetizes the field of the alternating-current generator; hence we have to increase the field excitation to hold up the voltage as shown in Fig. 1. Leading current, however, magnetizes the field of an alternating-current generator, and thus, at a certain leading power-factor, we should have no rise in voltage if the load were thrown off, or 0 per cent regulation. If the leading power-factor was further increased, we should have a drop in voltage instead of a rise, or "negative regulation." If the load at various lagging power-factors were thrown off, speed and excitation remaining constant, we should have a certain rise in voltage equal to the difference between the no-load voltage as found on the no-load saturation curve (corresponding to the excitation) and normal voltage. The ratio of this rise in voltage and normal voltage expressed in per cent is termed the regulation of the alternator. Fig. 3 gives the full-load kva. regulation and efficiency curves at various lagging power-factors of the above alternator based on test results as given in Fig. 1. Friction and windage losses have not been included in calculating the efficiencies, this alternator being of the "engine type" furnished without shaft and bearings. It will be noted that the regulation and also the efficiencies become poorer and poorer as the lagging power-factor increases.

The field winding of the alternator discussed above was designed for 125 volts excitation, and, allowing for 5 volts drop in brushes and line, which is a fair estimate, 120 volts is the maximum available voltage at the collector rings. Referring to Fig. 1, this would correspond with a field current necessary to hold up voltage at full kva. load at 0 per cent lagging power-factor.

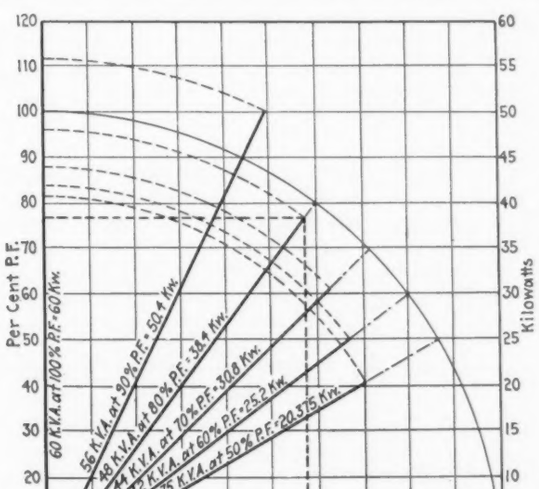
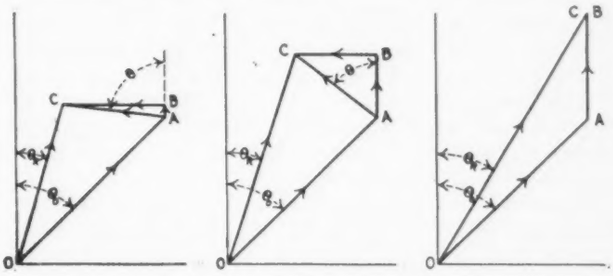

60 K.V.A. at 100% P.F.=60 Kw.
56 K.V.A. at 90% P.F.=50.4 Kw.
48 K.V.A. at 80% P.F.=38.4 Kw.
44 K.V.A. at 70% P.F.=30.8 Kw.
42 K.V.A. at 60% P.F.=25.2 Kw.
40.75 K.V.A. at 50% P.F.=20.375 Kw.
Per Cent P.F.
Kilowatts
Wattless K.V.A.

FIG. 4—APPROXIMATE MAXIMUM OUTPUT FOR THE ALTERNATOR OF FIG. 1

**Alternator-Field Excitation and Heating**

As the field excitation is increased the field-current heating will increase, and the per cent increase in field resistance, or the constant by which field resistance at




FIGS. 5, 6 AND 7—VECTOR RELATIONS WHEN SYNCHRONOUS MOTOR IS FLOATING ON LINE, CARRYING SOME MECHANICAL LOAD, AND WITH FULL-RATED MECHANICAL LOAD

25 deg. C. has to be multiplied to give the resistance at the corresponding temperature rise, may be plotted to field amperes as shown in Fig. 1, giving the field-heating curve as measured by resistance. Referring to Fig. 1, we obtain the figures of the table.

It may be noted that generally the critical or maximum condition of operation at low power-factor is limited by the field-circuit heating and the ability to hold up voltage. The maximum condition of operation at unity power-factor is limited by the armature heating and the mechanical strength of the machine, and will in most cases be limited by the maximum overload the prime mover will carry. At lower power-factors, however, the prime mover runs more or less idle, depending upon the output. Now the central-station income de-

FIELD RESISTANCE AND TEMPERATURE RISE AT DIFFERENT POWER-FACTORS

| Power-Factor in per Cent | Load in Kva. | Field Current | Increase in Field Resistance in per Cent | Temperature Rise Above 25 Deg. C. in Deg. C. |
|---|---|---|---|---|
| 100 | 40 | 14.8 | 7.2 | 19 |
| 90 | 40 | 19.6 | 11.5 | 30 |
| 80 | 40 | 21.5 | 14.1 | 37 |
| 70 | 40 | 22.8 | 16.0 | 42 |
| 60 | 40 | 23.8 | 17.1 | 45 |
| 50 | 40 | 24.4 | 18.2 | 48 |

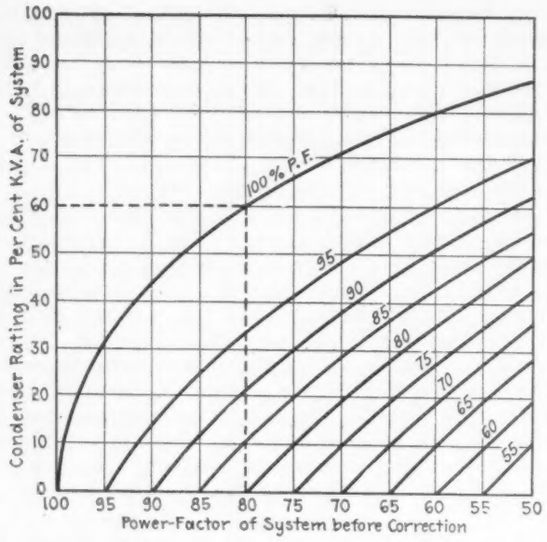



FIG. 8—CONDENSER CAPACITY REQUIRED TO CORRECT POWER-FACTOR OF A SYSTEM. CURVES SHOW POWER-FACTOR AFTER CORRECTION

pends upon the number of kilowatt-hours sold. The cost of the central-station equipment, however, depends on the number of kilovolt-amperes. Therefore, wattless current or wattless kva. is unprofitable. Whereas it requires the same attention and same equipment as the watt current, it does no work. Capital invested in any plant furnishing power yields less interest and profits the more wattless current it produces; that is, the lower the operating power-factor is.

In the vector diagram of Fig. 4, the kva. vector at any power-factor from 100 per cent to 0 per cent is the resultant of two components. The watt component $=$ kva. $\times \cos \theta$, and the wattless component $=$ kva. $\times \sin \theta$. Based on test results as shown in Fig. 1, the vector diagram Fig. 4 gives the approximate maximum kva. output the alternator will carry as limited by the

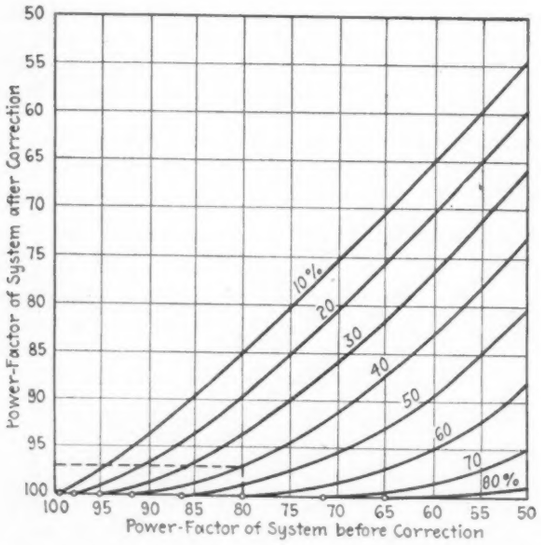



FIG. 9—EFFECT ON A SYSTEM OF ADDING CONDENSERS OF DIFFERENT RATINGS. CURVES SHOW CONDENSER RATING IN PER CENT OF SYSTEM KVA.

Suppose it is desired to know how high the power-factor of a 500-kva. system of 80 per cent lagging power-factor can be raised by operating a 200-kva. synchronous motor as a condenser at zero per cent leading power-factor. The condenser has a rating equal to 40 per cent of the system. By reading from 80 per cent on the horizontal scale to the 40 per cent curve and across to the vertical scale, it is found that the system power-factor may be raised to 97 per cent.

prime-mover capacity, mechanical strength of the alternator, heating or ability to hold up voltage, these limits being assumed as follows:

The prime mover is able to operate with 50 per cent overload as a maximum; that is, when the alternator output is 60 kva. at 100 per cent power-factor. The alternator for mechanical reasons can safely stand such overload. The heating limit for armature and field coils may be set at 60 deg. C. temperature rise as measured by resistance, and the maximum available exciter voltage is 125 volts, which as referred to before would mean 120 volts at the collector rings.

The evil effects of poor or low power-factor on an electrical system may be summed up as follows:

1. Poor efficiency, since losses are increased with decreased kilowatt output, or, in other words, reduced capacity of generators, transformers, transmission lines and other electrical equipment; a tendency, therefore, to decrease the number of kilowatts per square foot in the station.

2. Insufficient or undue increased exciter capacity, frequent inability to hold up or maintain full voltage,

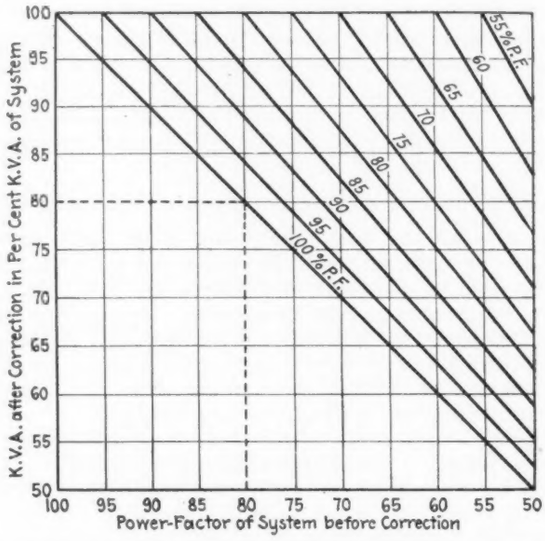



FIG. 10—RESULTANT KVA. AFTER CORRECTION. CURVES SHOW POWER-FACTOR AFTER CORRECTION

Suppose it is desired to know what kva. will be available for a 500-kva. system operating at full load at 80 per cent power-factor when this power-factor is corrected to 100 per cent by a synchronous condenser. By following the dotted line from 80 per cent on the horizontal scale to the power-factor curve of 100 per cent and then across to the vertical scale, it is found that after correction 80 per cent of the system kva. will be in use and 20 per cent available.

and causing undue and excessive heating in the generator field coils.

3. Exceedingly poor regulation, a Tirrill regulator being of little use on account of the extreme exciter voltage which must be maintained and also on account of the sluggish action of the highly saturated magnetic circuits.

### Rotary Condenser and Synchronous Motor as Power-Factor Correctors

As already mentioned, leading current tends to magnetize the field of an alternator and, therefore, directly tends to compensate the demagnetizing action of the lagging current. Since in a generator the rotation is against, and in a synchronous motor with, the magnetic attractions and repulsions between field and armature, lagging current will magnetize and leading current will demagnetize the field of a synchronous motor. Therefore an over-excited synchronous motor—that is, excited to give a counter emf. greater than that of the line

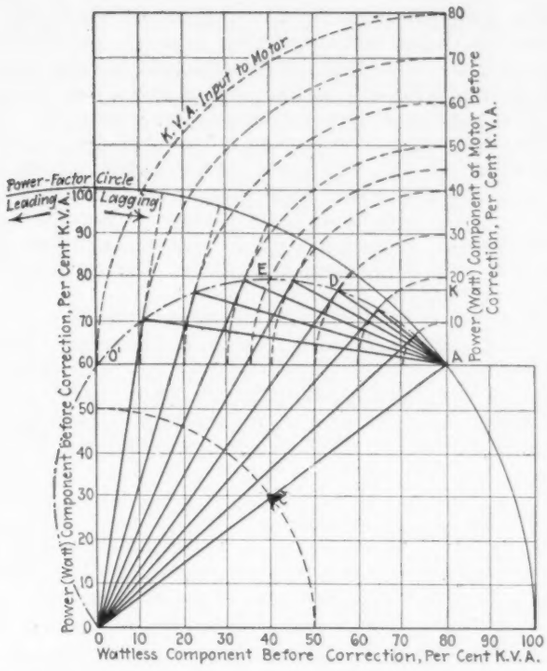



FIG. 11—VARIATION OF POWER-FACTOR CORRECTION OF A SYNCHRONOUS MOTOR BY ADDING MECHANICAL LOAD

to which it is connected—will introduce a current that tends to magnetize the field of the generator and demagnetize that of the motor—in other words, leading current. Thus an over-excited synchronous motor connected to a certain kva. system at lagging power-factor will raise the power-factor of the system,, relieve the generator from its critical condition of operation as limited by field heating and holding up of voltage, and allow for additional load; that is, increase the kilowatt output of the generator. Now, a synchronous motor connected to a system will draw a certain amount of kva. from the line. This kva. vector is the resultant of two components: (1) the watt component necessary to overcome the losses in the motor—core, armature ($I^2 \times R$), field ($I^2 \times R$), friction and windage losses—plus the kilowatt mechanical load the motor is actually driving; (2) the wattless component, depending upon the over-excitation given the synchronous motor, or the leading power-factor of same.

Figs. 5, 6 and 7 give three vector diagrams showing a synchronous motor connected to a certain kva. system, vector $OA$ at a certain lagging power-factor ($\cos \theta_0$) in all cases drawing the same amount of kva., vector $AC$, from line, but with field excitation or leading power-factor ($\cos \theta$) and mechanical load, vector $AB$ varied as shown.

In Fig. 5 the synchronous motor is running idle or "floating on the line" as a condenser. Vector $AB$ = watt-component necessary to overcome the losses in the motor. With field excitation adjusted so that the motor draws normal kva., vector $AC$ from the line $\cos \theta$ = leading power-factor on motor (in this case approximately 0). Vector $OC$ represents resulting kva and $\cos \theta_r$ the power-factor after correction.

Referring to Fig. 6, the motor in this case is carrying some mechanical load. Vector $AB$ = total losses of motor plus kilowatt output. As the kva. input, as assumed above, remains the same, the leading power-factor, $\cos \theta$, has decreased in value compared with condition Fig. 5. In this case the power-factor $\cos \theta_r$ is lower than in Fig. 5, but the motor is now doing some mechanical work besides having a correcting effect.

In Fig. 7 the motor is carrying its full-rated mechanical load at 100 per cent power-factor on the motor. The wattless component, $BC$, is in this case 0, and although the power-factor correction in this case is less than in Figs. 5 and 6, the motor is correcting the power-factor of the system while running at unity power-factor.

It may be seen that for approximate determination of power-factor correction, as obtained by a synchronous motor floating on the line or as a condenser, the losses of the synchronous motor may be neglected; that is, assuming 0 per cent power-factor leading on the motor. Based on this assumption, power-factor correction curves are constructed for practical use as per Fig. 8.

### When Synchronous Motor Carries Mechanical Load

With a given synchronous motor available for correction of a certain system, the question arises: Is it necessary, in order to attain the highest power-factor correction, to operate the synchronous motor as a synchronous condenser carrying only a mechanical load necessary to cover the losses in the motor when running idle, or can the synchronous motor deliver mechanical work without sacrificing the power-factor correction—it being understood that the kva. input of the motor remains approximately the same and that the prime mover is capable of taking care of increased mechanical load? This problem may be easily solved, using Fig. 11.

In the diagram vector $OA$ represents the system operating at full kva. capacity, 60 per cent lagging power-factor. Not taking the losses into consideration, a synchronous motor running idle or at 0 per cent power-factor leading added to this system will vectorially add in phase with the wattless component or along $AO$. If mechanical load is carried by the condenser, the kva. input remaining the same, the kva. vector is the radius of a circle having its center at $A$. With increased mechanical load the power-factor of the motor will vary from 0 per cent leading to 100 per cent, the field of the synchronous motor being adjusted from maximum over-excitation to normal excitation at 100 per cent power-factor. It is obvious that the resulting kva. component of the system will at a certain point ($D$) become tangent to the kva. circle of the motor. At this point we have maximum power-factor of the system with a maxi-

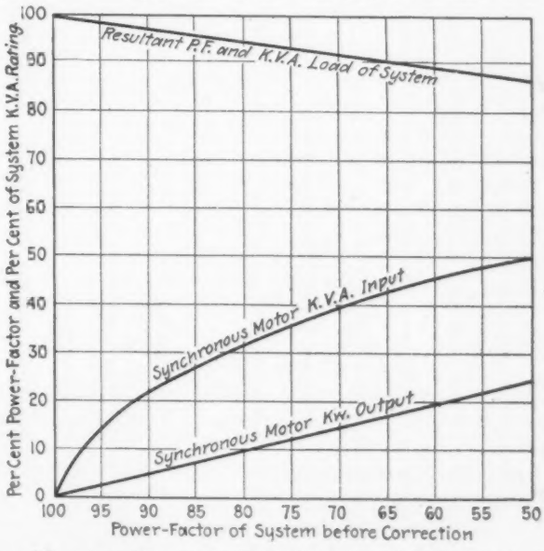

Resultant P.F. and K.V.A. Load of System
Synchronous Motor K.V.A. Input
Synchronous Motor Kw. Output
Per Cent Power-Factor and Per Cent of System K.V.A. Rating
Power-Factor of System before Correction

FIG. 12—RATING OF SYNCHRONOUS MOTOR THAT WILL PERMIT GREATEST MECHANICAL LOAD WHILE EXERTING ITS MAXIMUM POWER-FACTOR CORRECTION

Suppose it is desired to know what rating of synchronous motor is best suited to carry a mechanical load and correct the power-factor on a 1000-kva. system operating under full load at 60 per cent lagging power-factor. By following the dotted line from 60 per cent on the horizontal scale, it is found that the kva. input should be 45 per cent of the system kva., the kilowatt output 20 per cent, with the resultant kva. load of the system reduced to 89.5 per cent and the power-factor to 89.5 per cent.

mum mechanical load on the motor. The power-factor will be indicated by the intersection of *OD* and the power-factor circle. The resultant kva. of the system will be indicated by the length of *OD*, and the mechanical load on the motor will be indicated by the watt component *AK*.

Any increase or decrease in mechanical load on the motor will decrease the power-factor of the system. In the diagram the circles having their centers at *A* represent the loci of various kva. inputs to the synchronous motor. It will be noticed that the points of maximum power-factor correction for various kva. inputs to the motor form the circumference of a semicircle constructed on the kva. vector of the system before correction. This can be proved geometrically.

### Size of Synchronous Machine Required

In Fig. 11 it is shown that the point *E* determines the size of synchronous motor (rated in kva. input) that will give the largest mechanical load to a system of given power-factor while giving its maximum power-factor correction. When the motor required has been added to a system the resultant kva. load of a system in per cent of what it was before correction will be equal to the resultant per cent power-factor of the system. This can be proved geometrically.

For any power-factor a synchronous condenser of given kva. input will correct the power-factor to a certain point. By adding mechanical load we can correct the power-factor still more. For a given power-factor there is one size of motor (rated in kva. input) that will deliver the largest mechanical load to the system while operating at its maximum power-factor correction. With this motor added, the resultant per cent kva. and power-factor will be equal (kilowatt losses in motor disregarded). Any variation in size will give less mechanical load while operating at its maximum power-factor correction.

From an economical and technical standpoint, the place of the synchronous motor or condenser in the system affects its corrective tendency on the system. It must be understood that, although when placed in the immediate neighborhood of a generator it relieves the generator from the effect of low power-factor operation, it does not tend to relieve the system as a whole. Situated, however, at the end of the line, it will improve conditions in the intermediate transmission lines and equipment. It is, of course, a matter of calculation to place properly the synchronous motor in the system. Plant and line conditions will, in conjunction with cost of investment in such apparatus, play a more or less important part in its use.

# Training Men for the Electrical Industry—II

## Details of Courses of Study and Lecture-Room Work in the Chicago Central Station Institute—Analysis of Individual Students

A general account of the purposes and scope of the Chicago Central Station Institute was given in the ELECTRICAL WORLD of Oct. 30, beginning on page 962. In this preceding installment the work of the institute for the Commonwealth Edison Company of Chicago and the associated companies of which Samuel Insull is the head was outlined, and the fact was pointed out that the inauguration of the employees' and technical graduates' courses has made for a closer contact between men and company. In the present article, which concludes the account of the institute's work, more detailed attention is given to the methods and courses of study of the institute, plan of organization, arrangement of classes, grading of candidates and students, courses of lectures, etc. Part of the last school year's lecture program is printed.

With some changes as to details of its methods, the Chicago Central Station Institute has continued to follow the main lines of development which it laid down in 1912. The three completed years of existence have not caused divergence from the idea of furnishing educational advantages for two kinds of men—first, those already employed by the companies of which Samuel Insull is the head; second, selected college graduates who are offered openings in the institute with a combination of employment and institute instruction. From the beginning the officers and directors have been as follows:

### Officers and Instructors

President, E. W. Lloyd; vice-president, Charles A. Munroe; secretary and manager, Fred R. Jenkins; treasurer, William A. Fox; auditor, J. H. Gulick; directors, Frank J. Baker, John F. Gilchrist, Martin J. Insull, E. W. Lloyd and Charles A. Munroe.

The educational committee is composed of John F. Gilchrist, Fred R. Jenkins, John G. Learned and E. W. Lloyd. Frederic A. DeLay, head instructor of the institute, has charge of the graduate student class. Mr. DeLay is a graduate of the University of Wisconsin and has had many years of teaching and practical engineering experience. George Goldman is instructor for the employees' classes. Mr. Goldman is a graduate of the University of California and has had several years' experience in teaching and engineering.

### Recruiting Candidates for Graduate Course

The course for college graduates who get practical experience with the companies begins on Aug. 1 and lasts for eleven months. The preparation for this, however, starts during the previous winter. Mr. Jenkins, the manager and secretary, is in correspondence with professors of electrical engineering and others in a large number of universities. He describes the qualifications demanded by the institute and asks for names of students who appear to have them. This is followed by personal visits to nearby universities. On these occasions Mr. Jenkins addresses the senior classes in electrical engineering and tells what he wants. In 1915, for instance, he went to Wisconsin University, the Armour Institute of Technology, the University of Illinois and Purdue University. He asks interested students to discuss the matter with him after class hours. Usually two trips of this nature are made, one in March and one in May. On the first trip Mr. Jenkins suggests that the students "think it over," and on the second trip the talks are more definite.

In the first year, beginning in 1912, forty students were enrolled; in the following year there were twenty; in 1914-15 there were twenty-five, and at the end of the year, as it developed, more were wanted for the different departments than the number enlisted. In the present year twenty-four are taking the course. The number is determined by conferences with the heads of

departments, who decide how many men available through this channel will be wanted.

The accepted applications on Aug. 1, 1915, for the 1915-16 course were from graduates of the following universities and colleges: Arkansas, two; Bliss, two; Cornell, one; Harvard, one; Illinois, seven; Ohio, one; Pratt, one; Purdue, five; Union, one; Kansas, one; Lafayette, one; Wisconsin, one. In these and various other institutions the plan of the institute is well understood and advertised. Already several applications have been received for the year 1916-17.

### Basis for Analysis of Student's Record

The record of the graduate student, on which he is considered for enrollment, covers, among various particulars, his nationality, health, college debt, earnings during college course, student activities and vacation work by years, scholarship record, ambitions, degree of interest in the Chicago Central Station Institute course, and immediate plans. It also provides for an appraisement of the following qualities: Personality, tact, physique, industry, habits, accuracy, aggressiveness, enthusiasm, system, attitude, refinement and neatness.

In writing to those who are given as references Mr. Jenkins explains that the object is "to enroll men who have a good general education, a good foundation in the theory of electricity, and who are naturally adapted for the business side of the industry. To these will be given the proper training and further education along commercial lines which will fit them for employment in the companies interested in this institute." The recipient of the letter is asked to grade the student as to honesty, scholarship, personal appearance, personal habits, courtesy, ambition, refinement, health, affability, industry, neatness, thoroughness, perseverance, cheerfulness, judgment, quickness, initiative, mental activity, punctuality, accuracy, aggressiveness, originality, application and clearness. He is also asked: "From your knowledge of the applicant, may we be justified in expecting him to rise to the higher positions in the business after he has received the proper training?"

### Classroom and Departmental Work

The division of time for the students is followed without change through the period of eleven months. Each week-day morning except Monday is given to classroom work or to supplemental inspection trips or demonstrations. The entire day on Monday and every afternoon except Saturday, which is a holiday, are given to departmental work.

In their company work the men are rotated through the power, lighting, appliance, sign and estimating divisions of the contract department; the street division of the operating department, the distribution engineers' department, the system regulation department, the customers' inspection division, the auditing department, the accounting and collection divisions, the steam-heating division, Federal Sign System (Electric), and the Evanston and Oak Park offices of the Public Service Company of Northern Illinois. As the general plan is to have every student spend one month in each place he enters, only a part of the departmental work indicated in the foregoing list is possible in all cases. In any event the student has experience in several branches of the commercial department. Under special conditions students may remain in one place for two months, and the schedules are so arranged as to permit flexibility.

A thorough system of records is kept in regard to the attendance and work of students in both classroom and department. A record for the classroom is kept by the instructor and is based on observation and on the quality of notes taken by the student of the proceedings from day to day.

### Records of Classroom Work

In the criticism of classroom work the instructor considers the following: Punctual, industrious, reliable, tactful, observant, attentive, aggressive. Under "personality" he notes the attitude of the student on the following: Frank, courteous, attractive, sincere, self-assertive, reticent, neat, keen, thorough. Under "dominant characteristics" the instructor may indicate: Forceful, persevering, reliable, observing, accurate, hon-

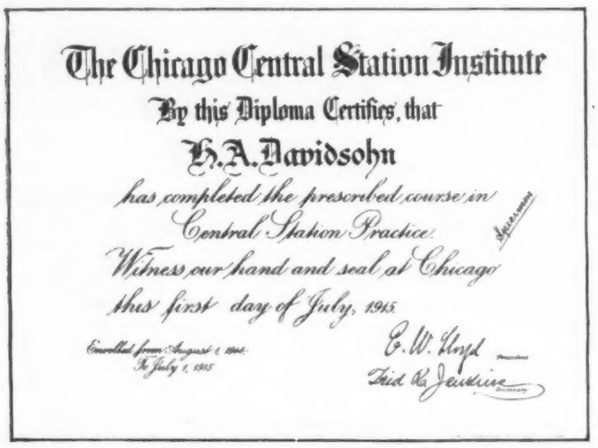
A LECTURE-ROOM VIEW IN THE CHICAGO CENTRAL STATION INSTITUTE, SHOWING INSTRUCTOR AND GROUP OF STUDENTS AT A DEMONSTRATION OF ELECTRICAL MACHINERY

est, magnetic, systematic, has concentration or has initiative.

The points suggested for marking are: Personality, 10; attendance, 10; punctuality, 10; classroom work, 40; department work, 30; total, 100. For classroom work there are three grades: A, 40; B, 30; C, 20. For department work there are three grades: A, 30; B, 20; C, 15. Absence means minus 2, tardy minus 1.

"Personality" is based on popularity, self-reliance, address and personal appearance. Mr. Jenkins said to the representative of the ELECTRICAL WORLD: "In preparing a system of marking under these conditions many people would rate personality higher than 10. But we feel that the qualities of personality are involved to a large extent in the rating for classroom work and department work. A good marking will not be obtained in those unless the personality is one of pleasing qualities. Some authorities rate personality at 50, but we think that our classification covers the main points that concern our work."

Once a month a list of students is posted showing the relative rank without the actual figures of standing. Students are kept informed about their actual standing. A poor record or report is brought to the attention of the delinquent student immediately.


The Chicago Central Station Institute

By this Diploma Certifies, that

H. A. Davidsohn

has completed the prescribed course in Central Station Practice.

Witness our hand and seal at Chicago this first day of July, 1915.

Enrolled from August 1, 1914. To July 1, 1915

E. W. Lloyd

Fred R. Jenkins

DIPLOMA ISSUED TO GRADUATE OF INSTITUTE

To enable the institute to judge the ability shown in department work semi-monthly reports are received from the men who have immediate supervision of the student. Fair, careful grading is requested. A classification of three grades, indicating the quality of work, is provided. Two specific questions are asked: In what does this man excel? In what is he deficient?

The information is condensed on a record which covers practical experience, educational training and sales experience. A photograph of the student is part of the permanent record on this card.

### Three Ten-Month Courses for Company Employees

The work of the institute among present employees of the companies takes the form for the present year of three ten-month courses. Each course consists of one lesson a week from Sept. 1, 1915, to July 1, 1916. The classroom hours are from 4 p. m. to 6.30 p. m. This is a change from the plan of evening classes followed in previous years. The hours were altered because men were a little tired for study after a day's work. The change also saves them in most cases the expense of dinner downtown. Course No. 1, covering "Magnetism and Electricity," is on Mondays. Course No. 2, "Engineering and Operating," is on Wednesdays. The most advanced work, Course No. 3, "Commercial Engineering," is on Fridays. For each course a tuition fee of $20 is charged, payable $4 upon enrollment and the balance at the rate of $2 per month. Course No. 1 or its equivalent is a prerequisite to either the second or third course. Upon satisfactory completion of any course a certificate is given. Before the application of an employee is accepted it must be approved by the head of his department. Those who take the courses are permitted to leave their work at whatever hour is necessary to enable them to be at the institute by 4 p. m., and this means from a few minutes to an hour before the time appointed.

The following outline indicates the scope of the courses:

*Magnetism and Electricity.*—Fundamental laws of magnetism and electricity, followed by study of direct generators and motors; the different metals and their alloys for transmission and other electrical purposes; insulations and insulators; panels and cabinets; primary and secondary batteries; protective devices; illuminants and miscellaneous electrical devices, such as fans, heating appliances, etc.

*Engineering and Operating.*—Generation, transmission and distribution of electricity. Beginning at the coal pile, the steps in the conversion of energy are considered, together with the apparatus for making the transformation, through the distribution system to the consumer. Alternating-current theory is studied before alternating-current apparatus.

*Commercial Engineering.*—Principles of salesmanship; essential characteristics of salesmen's duties and reports. Merchandising: Factors in distribution, organization of department, policies, stocks, source of losses. Theory of advertising as a factor in the economical distribution of goods, as an educational factor, technique, mediums. Accounting: General principles, balance sheet, assets and the principles of valuation, profit and loss account, surplus and reserve, trading, manufacturing and cost accounts.

*Illuminants.*—Illuminating engineering, theory and practice. Electric signs, meters and metering. Rates and rate-making. Industrial motor application.

### Illustrated Lectures by Specialists

The three courses are supplemented by special illustrated lectures by specialists in the companies and by representatives of manufacturers. Many experimental demonstrations are also conducted.

A detailed record of the progress of the employees in the classroom is kept. It is based on examinations and on the observations of the instructor.

Another feature of the institute work, the plans for which have not yet been announced for the current year, is special lecture courses. During the last institute year two courses were given, on "Engineering and Operating" and "Commercial Engineering" respectively. The lectures were given on Monday and Friday evenings from Feb. 1 to June 28. They were delivered mainly by officials of the Commonwealth Edison Company or other Insull properties. Several others, however, gave lectures.

The scope of the lectures is well shown by these illustrations: "Service," Samuel Insull; "Working Organization of Electric Public Utility Corporations," John F. Gilchrist; "The Development of the Central Station," Louis A. Ferguson; "Securities of Public Utility Corporations," E. P. Russell of Russell, Brewster & Company; "Rates and Rate-Making," E. W. Lloyd; "Effect of Electrical Construction on Fire Hazard and Insurance Rates," William S. Boyd, electrical inspector Western Insurance Union; "Heating Appliances," J. D. A. Cross, General Electric Company; "Theory of Organization," Frank F. Fowle, Central Union Telephone Company.

# Station and Operating Practice

*A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.*

## Operating Features of Large Electric-Vehicle Garage

### Charging Equipment and Methods Employed—Wiring Arrangements and Switchboards Devised for Garage and Battery Departments—Forms for Recording Operating Data

THE Exide Battery Depot & Electric Vehicle Garage, at 527-541 West Twenty-third Street, New York City, is one of the largest plants maintained for battery repair and assembly and electric-vehicle charging. One of the operating features of this station is the method employed for energizing batteries by starting the charge at 105 volts and finishing at 125 volts when necessary, thus minimizing the loss of energy in rheostats. The lower voltage is usually high enough to maintain the desired charging rates until 80 per cent to 90 per cent of the energy necessary for recharge is put into the batteries. This effects a saving of from 12.5 per cent to 15 per cent in the power bill.

#### Garage Wiring and Switchboard

The garage is wired with eighty circuits of 100-amp. rating each. The switchboard room, shown in Fig. 2, contains one main distribution panel carrying an ammeter and a recording voltmeter for each bus and a charging-circuit switchboard made up of ten panels of eight circuits each. The arrangements of the wiring for these panels are shown in Fig. 3. All of the switches in the same vertical row are for the same circuit. The upper clips of each row of broken-back switches are connected with the positive 125-volt and 105-volt busbars respectively, while the lower clips are connected with the separate auxiliary busbars. Between the different voltage busbars and their corresponding auxiliary busbars are ammeter shunts. The hinges of the broken-back switches are connected with the forward and rear clips of the double-throw switches. The hinges of the latter are connected with their particular battery-charging circuits through Allen-Bradley carbon-pile rheostats. The negative cables run directly to the charging plugs and do not enter the switchboard room at all. A common negative is used for both buses.

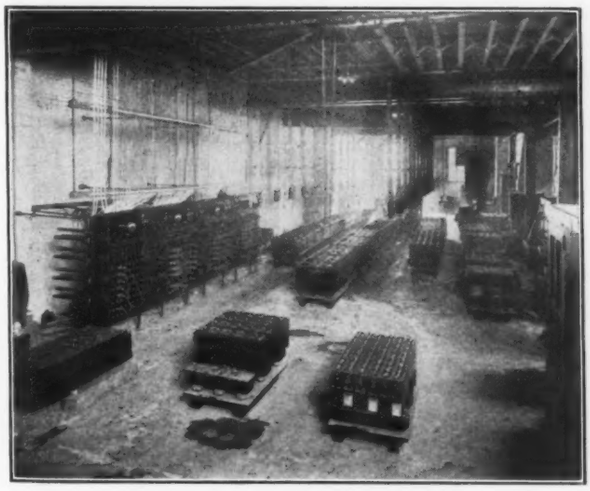


FIG. 1—BATTERY-ASSEMBLY DEPARTMENT, SHOWING CHARGING AND DISCHARGING SWITCHBOARD

When starting to charge, the double-throw switch is thrown in the front position, which connects that circuit with the lower-voltage busbar. When the counter emf. of the battery builds up so that the proper charging rate can no longer be maintained with the 105-volt sup-

FIG. 2—SWITCHBOARDS FOR CHARGING BATTERIES IN GARAGED VEHICLES

ply, the switch is thrown into the rear position connecting the battery to the 125-volt busbars. The purpose of the broken-back switches is to permit reading current in various circuits. When a circuit is connected with the lower voltage busbars, the current is read by throwing the lower broken-back switch to the lower position. A similar operation is performed with the upper switch to read the current when the battery is connected with the 125-volt circuit. The current is read on separate ammeters in each case. The voltage of any battery is read by inserting the plug into a receptacle over its particular circuit. Two ammeters, one for each busbar, and one voltmeter suffice for each set of eight circuits. With these connections there is no possibility of interconnecting the 125-volt and 105-volt busbars.

#### Garage Charging Methods

A modified constant-potential or maximum-voltage method of charging is used. The daily charge is begun at approximately 90 amp. for all batteries regardless of the size and maintained at as high a charging rate as possible until the voltage of the battery reaches a point indicating that the cells have begun to gas, this being approximately 103 volts for forty-two-cell batteries and 107 volts for forty-four-cell batteries. When the gassing voltage is reached, the charging current rate is regulated by means of the rheostats so that the voltage will rise no higher until the current has been gradually reduced to the "finishing rate." As noted previously, when the desired current can no longer be obtained on the 105-volt bus, the battery is changed over to the 125-

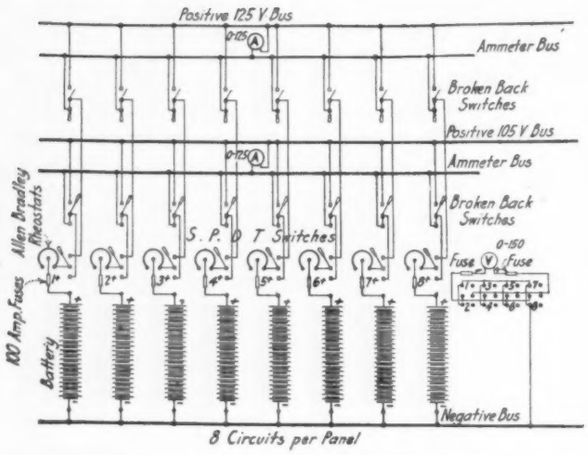



FIG. 3—SWITCH CONNECTIONS FOR ONE OF THE TEN CHARGING PANELS

volt bus by means of the corresponding single-pole, double-throw switch shown on the horizontal table of the charging switchboard in Fig. 2. When the charging rate has been reduced to the finishing rate by regulating it to meet the gassing voltage as noted above, the finishing rate is maintained until the battery voltage reaches a point at which it remains constant for three consecutive readings taken at one-hour intervals, when the daily charge is considered completed. It is important when charging by this method that the charge be continued to a maximum voltage and not a fixed voltage. The maximum voltage of batteries of the same number of cells will vary somewhat for batteries of various-sized cells and varying ages and types of plates and also with the same battery at different temperatures, so that the maximum voltage must always be used to determine the completion of the charge, and never a fixed voltage.

The form used for recording daily charging data is shown at the top of Fig. 4, typical charge readings being given for four trucks. Printed figures over the vertical columns are the hours from 7 p. m. to 6 a. m., and the double figures in these columns show the current rate in amperes and the battery voltage respectively.

### Weekly Equalizing Charges and Monthly Inspection

Once a week each battery is pulled out of its corresponding truck and flushed with water just before the regular charge. Toward the finish of this charge, following flushing, hourly readings of gravity and temperature of two pilot cells are taken, and the charge is continued until three maximum gravity readings for both cells have been obtained. The readings of gravity and temperature of the two pilot cells determine the completion of the weekly equalizing charge and also serve as a check on the daily charges.

Once a month at the end of the equalizing charge individual-cell gravity and voltage readings are taken. If the specific gravity of the electrolyte is higher than 1300 or lower than 1250, or if the pressure of any cell at the finishing-charge rate is higher than 2.75 volts or lower than 2.40 volts, the cause is promptly investigated and corrected. Individual-cell gravity and voltage readings, as taken at the time of the monthly inspections, are reported on forms like that shown at the center in Fig. 4. Readings of gravity and voltage outside the limits noted above for individual cells may be caused by a small short-circuit inside cells, by careless equalizing, or by wash water getting in owing to drip covers needing repairs. It is always important to remedy trouble of this kind at the first indication.

Readings taken on daily charge, weekly equalizing charge and monthly inspection are turned into the office for checking and criticism after they have served the purposes of the garage. The garage is also equipped to make any mechanical repairs necessary and to overhaul vehicles thoroughly.

### Battery Depot Wiring and Switchboard Equipment

The battery depot is equipped to supply parts, make repairs and renewals, and build up new batteries for both pleasure vehicles and electric trucks, and will perform the same services for starting, lighting and ig-

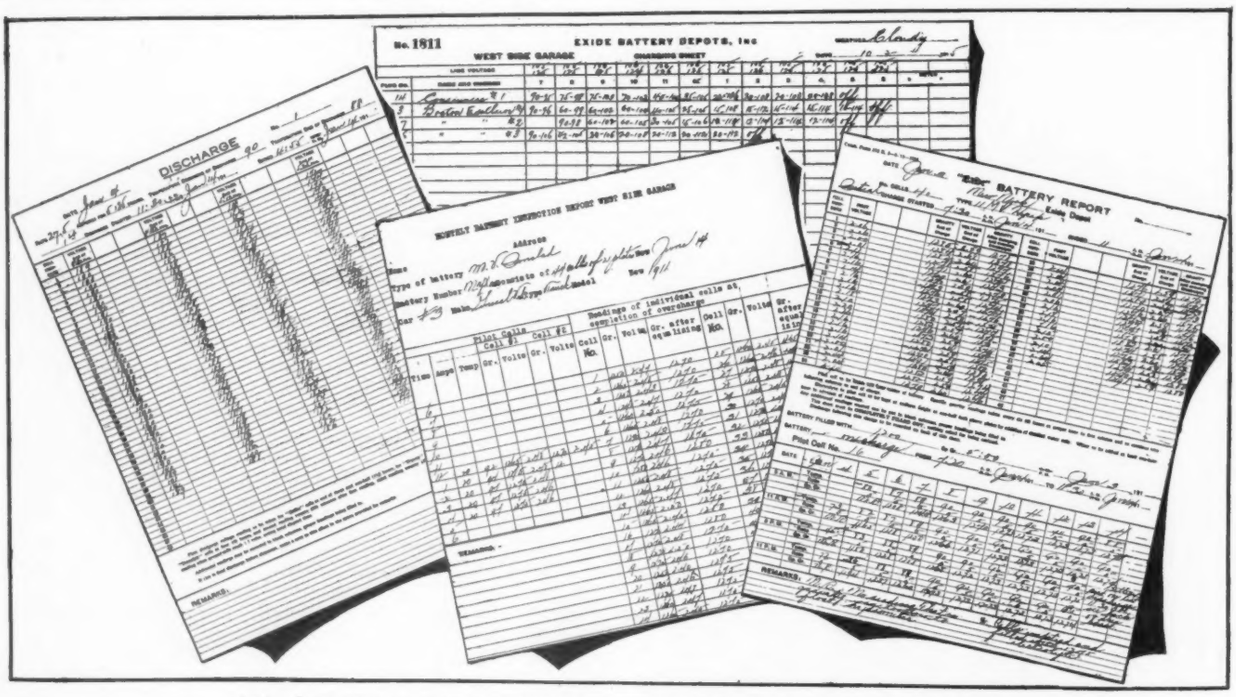



FIG. 4—SOME OF THE FORMS FOR RECORDING CONDITIONS OF BATTERIES

Sheet No. 1811 shows some records on vehicle charging. By inspecting the figures it will be seen that the first battery was fully charged when the voltage reached 108 volts, the second and third batteries not until they attained 114 volts, and the fourth battery when it attained 112 volts, indicating that the maximum rather than a fixed voltage should always limit the charging period.

nition batteries for gasoline cars. This portion of the plant is subdivided into a storeroom for parts, received from the factory in Philadelphia, and into two battery rooms, one for handling pleasure-car and truck batteries and the other for handling starting, lighting and ignition batteries. The charging equipment in this battery room consists of a switchboard having two panels of four circuits each, giving eight 125-volt charging lines, on each of which about forty-five cells in series can be charged. From this it will be seen that more than 100 three-cell batteries can be charged at one time.

The switchboard in the vehicle-battery room is arranged differently from that used in the garage. It consists of four eight-circuit panels and a corresponding number of carbon-pile rheostats. Each panel contains sixty-four plug receptacles, the upper row connecting with the negative busbars, the next two rows with opposite terminals of the battery-charging circuits, the fourth and fifth rows with the terminals of rheostats, the sixth and seventh rows with the 105-volt and 125-volt busbars respectively, and the lowest row with the discharging busbar. Thus by placing jumpers between receptacles in rows 1 and 2, 3 and 4, and 5 and 6 in the column having the same number as the circuit to which the battery is attached the battery will be connected across the 105-volt busbar. Changing the jumpers between 5 and 6 to join 5 and 7 will place the battery on the 125-volt circuit, and bridging 5 and 8 will connect the battery for discharging.

After a battery has been assembled or repairs completed it is connected for charging at a low rate. Readings are taken on each cell in the battery to determine whether the cells are properly connected. Following this, readings of gravity, temperature and current are taken every six hours on a pilot cell and the charge is continued until the pilot cell reaches maximum gravity. When this point is reached, indicating that the charge is completed, gravity and voltage readings of the individual cells are taken and gravity of the cells is adjusted so that all cells read between 1270 and 1280.

## Why an Induction Regulator Stuck and How It Was Repaired

BY E. C. PARHAM

With the exception of those induction devices that use magnetic leakage as a means of automatic regulation, the clearance in the active air-gap of all induction apparatus is kept a minimum in order to minimize magnetic leakage and magnetizing current. For this reason the air-gap clearance in well-designed feeder regulators is very small. Other clearances are made as small as practicable, because the weight of the device is thereby reduced without in any way impairing other good features of design. This limited clearance means that the coils with which regulators are wound or are repaired must be mechanically correct, or there is likely to be trouble from rubbing.

In one case where a feeder regulator was damaged during a lightning storm the operator rewound the regulator with a spare set of coils that he had on hand in the storeroom. The regulator operated satisfactorily after being replaced in service, and it continued to do so for several months. The driving motor then began to blow fuses with a frequency that increased. Finally the regulator stuck and something had to be done. The motor would operate all right when mechanically disconnected from the mechanism, but the regulator rotor could not be forced around by hand and it acted as if there were an obstruction in the air-gap. The oil was drawn off and the regulator disassembled. Inspection then revealed that the insulation on the bottom of the rotor coils was badly abraded, owing to rubbing between the coils and the bottom of the tank. The operator said that at the time the coils were installed they had fitted the slots snugly. If this was true, the drying incident to the heat of heavy loads must have shrunk them considerably, for they were all loose in the slots and had worked down to the lower limit of their end clearance. To relieve the situation the coils were removed and served with tape throughout the length of the slot. In reinstalling them they were kept as far as possible toward the upper end of the slots and were also wedged there so that they could not slip down even if the insulation should shrink.

## Motor Drive Adopted for Compressors and Other Equipment in Reading (Pa.) Ice Plant

BY A. L. HART, POWER ENGINEER METROPOLITAN ELECTRIC COMPANY

During the early part of 1914 the Reading Merchants' Ice Company, Reading, Pa., added to its plant a new 100-ton ice machine driven by a 300-hp. motor. The installation of this machine was based upon a decision to use electric service not only for operating the new unit but eventually for the entire plant equipment. The original equipment of the Reading Merchants' Ice Company's plant consisted of two 40-ton York steam-driven machines with the necessary condensing and freezing tank arrangements for a complete can system.

The water for the condensing coils of this plant is pumped from an artesian well by an air-lift pumping system. An air compressor is used for this purpose. The water is delivered to a concrete basin from which it is drawn by a motor-operated pump and forced through the ammonia condenser. A small quantity of

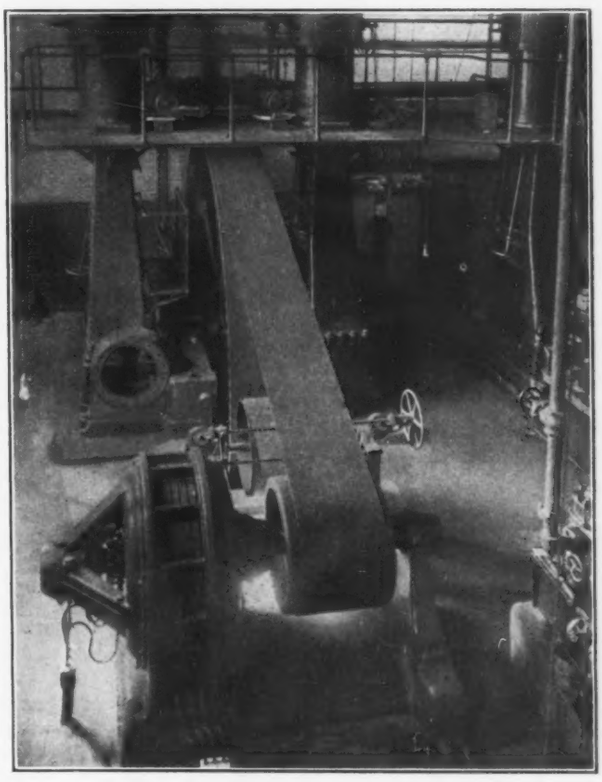


FIG. 1—A 40-TON ENGINE-TYPE AMMONIA COMPRESSOR DRIVEN BY A 150-HP. MOTOR

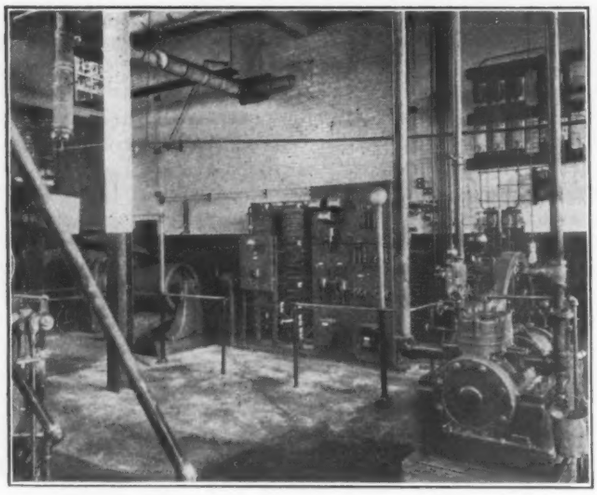


FIG. 2—SERVICE ENTRANCE, SWITCHBOARD AND MOTOR DRIVING 100-TON AMMONIA COMPRESSOR IN A READING (PA.) ICE PLANT

the water is sprayed over the ice cans just before removing them, to loosen the ice and make it slide out of the can easily. Another small quantity flows into a tank from which it is pumped into two 12,000-gal. storage tanks. From these tanks it passes through purifying apparatus and into a pure-water tank. It is then heated and fed automatically into a twelve-effect distilling apparatus. The distilled water thus secured flows into another tank, from which it is pumped and forced through cooling coils to reduce its temperature to about 42 deg. Fahr. From the cooling coils it is forced into a storage tank and drawn off to fill the freezing cans.

SIZES, TYPES AND NUMBER OF MOTOR-DRIVEN MACHINES

| Number of Machines | Name of Machine and Rating | Motor Hp. | Speed, R.p.m. |
|---|---|---|---|
| 1 | York 100-ton compressor | 300 | 514 |
| 1 | York 40-ton compressor | 150 | 600 |
| 1 | Centrifugal pump, 500 gal. per minute | 25 | 1200 |
| 5 | Centrifugal circulating pumps | 5 | 1800 |
| 4 | Agitators | 2 | 900 |
| 2 | Can hoists, 1 ton each | 1.5 | 600 |
| 1 | Elevator | 5 | 900 |

In this plant about 6 per cent of the water pumped from the artesian well is used for ice and loosening the ice in the cans, and about 94 per cent, or 3400 tons per day, is discharged from the condensers into the sewer.

One ton of ice is made in this plant at an energy cost of 42 kw.-hr. The coal cost to distill the water used is approximately four cents.

## Simple Changes in Grates Reduce Unit Repair Expense

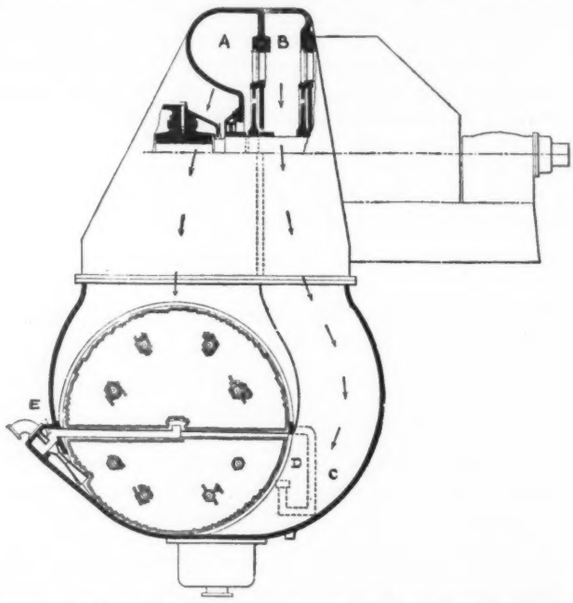
At one of the generating stations in the East, where inclined grate stokers are employed, trouble was experienced from some of the grate bars failing to agitate the fuel bed in the usual manner. On inspection it was found that the round bearing ends of the rocker bars which raise and lower the alternate grate bars had worn flat, thereby causing so much lost motion that the bars did not move through their accustomed range. Since replacing the rocker bars would have cost about $14 each, it was decided to remodel them as fast as they wore out so as to compensate for future wear. Accordingly the worn bearing ends of the bars were cut off and drilled to receive standard bearing pins. When these wear out they can be replaced by others at an expense of only a few cents each.

In this same station necessity has also led to the development of a scheme whereby the auxiliary grate bars can be repaired at small expense when their lower edges burn away. When the original bars become unserviceable they are replaced with two-section bars, only one section of which has to be replaced when the lower edges burn out, thereby cutting the cost of maintenance about in half.

## Steam-Turbine Operating Possibilities with a Two-Stage Condenser

By Paul A. Bancel

As another solution of the problem of designing steam condensers for overloads, which was referred to in an editorial in the Electrical World for Oct. 30, page 955, the writer calls attention to a two-stage design to be used in connection with a double-vacuum exhaust turbine. The features of this design are shown in the accompanying illustration. The first stage of the condenser receives its steam at a moderately high vacuum, while the rest of the steam passes through the final stage of the turbine and is condensed at the maximum vacuum. The steam exhausted from the turbine at the higher vacuum is condensed in the upper portion of the condenser, with the other portion




A TWO-STAGE CONDENSER FOR A DOUBLE-VACUUM TURBINE

condensed in a second section. The cold condensate from the high-vacuum section is passed into the low-vacuum section through the trap marked *C* and drips over a heater tray marked *D*, so that its temperature is raised and the heat that would otherwise be rejected to the circulating water is saved. The steam jets shown at *E* afford a means of discharging the air from the high-vacuum section into the low-vacuum condensing space. The air is finally drawn out by an air pump.

At overloads there is not only a loss of pressure in condensers, but also congestion in the turbine, particularly if the high loads are accompanied by high vacuum, so that even the impaired vacuum maintained by the heavily loaded condenser is not profitably utilized in a congested turbine. The design proposed contemplates

obtaining the very high vacuums on only part of the steam, so that the energy made available can be profitably utilized in a turbine wheel of moderate flow area, while the tubes in the corresponding section of the condenser are arranged to present the least resistance to flow of steam. The remainder of the steam is bled out and condensed at a slightly lower vacuum, and the condensate is all heated up to this temperature. The air is removed from the high-vacuum condenser by steam exhausters, as mentioned, and delivered into the low-vacuum condenser, from which it is withdrawn by the regular air pump. The circulating water, in passing through the high-vacuum condenser first and then the low-vacuum condenser, does double duty.

Where circulating water is scarce or has to be cooled artificially, as by cooling towers and spray ponds, the design presents exceptional possibilities for either increased economy or reduced cost. Installations with cooling towers seem to show that a gain of 3.2 per cent economy is possible without added expense for the cooling tower or cost of pumping water and only a slight increase in the cost of the condenser, or else the same economy may be maintained with a reduced cost of equipment of between $2,000 and $3,000 on a 1000-kw. high-pressure or 500-kw. low-pressure plant.

## A Method of Lifting Oil for a Gravity-Feed System by Use of Condenser Vacuum

BY ADOLPH KUYLENSTJERNA*

The accompanying diagram shows details of a scheme employed at the Springfield (Ohio) station of the Springfield Railway Company for operating an oiling system without the use of special oil pumps. The oiling system differs from that usually designed for a power plant in the use of the vacuum from the condenser or the condenser-vacuum pump to lift the oil from the filter to elevated storage tanks. The three parts of the system, as shown in the illustrations, consist of two elevated storage tanks, of a capacity of 50 gal. each, together with the accompanying valves; an oil filter and auxiliary storage tank (not shown but indicated by lettering near the pipes leading to them), and check valves in the pipe connecting elevated and low-level tanks.

*Mechanical engineer American Railways Company, Philadelphia, Pa.

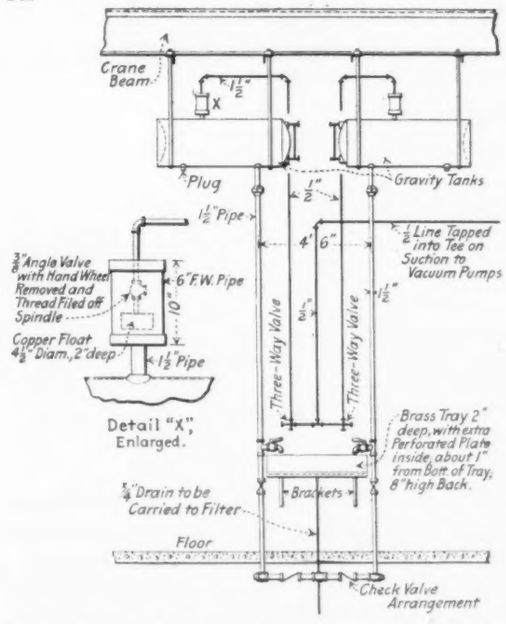



FIG. 1—STORAGE TANKS AND PIPING FOR VACUUM-OPERATED OILING SYSTEM

The suction pipes enter the elevated tanks at the top through a home-made check valve consisting of an angle valve operated by a copper float which rises when the tank is filled with oil. In the suction pipe line to each tank is a three-way valve operated by hand during the filling operation. In the filling position this valve puts suction on the tank; in the other position atmospheric pressure is applied, allowing for gravity feed to the bearing pipe line.

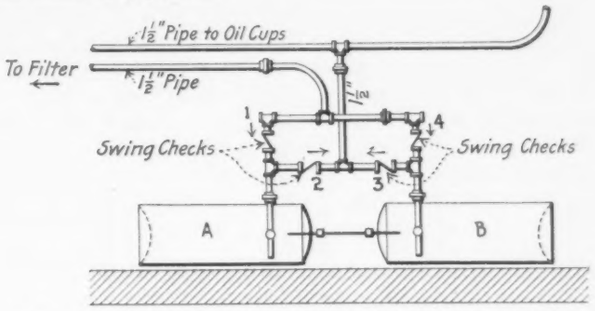



FIG. 2—ARRANGEMENT OF CHECK VALVES IN OIL-FEED SYSTEM

The check-valve arrangement in the feed line is shown in Fig. 2. It consists of four swing check valves numbered 1, 2, 3 and 4, which allow oil to flow in the directions shown by the arrows. When tank *A* is under suction, *B* is under atmospheric pressure. Then oil flows through valve 1 into tank *A*, and out of tank *B* through valve 3 to the oil cups, and vice versa.

With this arrangement it usually takes about five minutes to lift the contents of a barrel of oil from the basement to the elevated tanks. If the condensers do not happen to be in operation when the tanks are to be filled, the air pump can be started up for a few minutes. The suction pipe is tapped into the vacuum line near the air pump.

## How Motor-Starter Troubles Often Develop

BY A. C. HEWITT

When a new 100-hp., three-phase, sixty-cycle, 440-volt squirrel-cage motor was being installed in a cement plant and the motor and auto-starter had been set up, an assistant was left to connect the motor and starter. A printed sheet of instructions was furnished with the starter showing how to make the connections. As there were nine wires leading into the starter and only a small space to put them in, the connections made quite a network.

After the assistant had reported the completion of connections and that the motor was ready to run, the chief operator inspected the work. The wiring was neatly done and all joints had been soldered and taped. He then closed the switch and, with the belt off the motor, threw the starter handle to the starting position. The rotor started easily, but when the starter was thrown over to the running position the motor seemed to give a jerk that shook it very noticeably. It was found that the rotor started in one direction and reversed when the starter was thrown into running position. The assistant had crossed two wires on the line side of the starter and had not checked the connections from the diagram on the instruction sheet. It was no trouble to find the crossed wires, but it was one of those cases that seem very mysterious to the inexperienced assistant and that show the need of carefully checking original connections to prevent more serious damages.

# Marketing Electricity

*A Department on Selling Service and Widening the Use of Electrical Energy*

## Offer of Appliances in Return for Sales Hints Results in New Record for Housewiring at Minneapolis

Up to Oct. 1 the sales department of the Minneapolis (Minn.) General Electric Company had taken orders for wiring 1421 already-built residences, while the independent efforts of the electrical contractors probably produced several times this amount of business. These figures take no account of new residences built during the year, practically all of which are wired. Apartment buildings are, moreover, classified as single buildings. The number of orders taken by the company represents a 28 per cent increase over the first ten months of 1914 and is double the number of contracts taken in the corresponding period of 1913.

Much of the success of this season's efforts is attributed to the giving of electrical appliance premiums to customers of the company who submitted the names of "prospects" for housewiring and to the advertising which was used in connection with the plan. According to the advertised plan, the customer giving the name of the prospect received his choice of a list of electrical devices such as flatirons, toasters, table stoves, coffee percolators, etc., if the company's salesmen were successful in closing the order.

The number of new lighting customers gained by the Minneapolis General Electric Company for the month of October approximates 1000, representing a high-water mark in the history of the organization. On Oct. 22 all local records for a single day's electrical output were broken with the delivery of 475,100 kw.-hr. of energy.

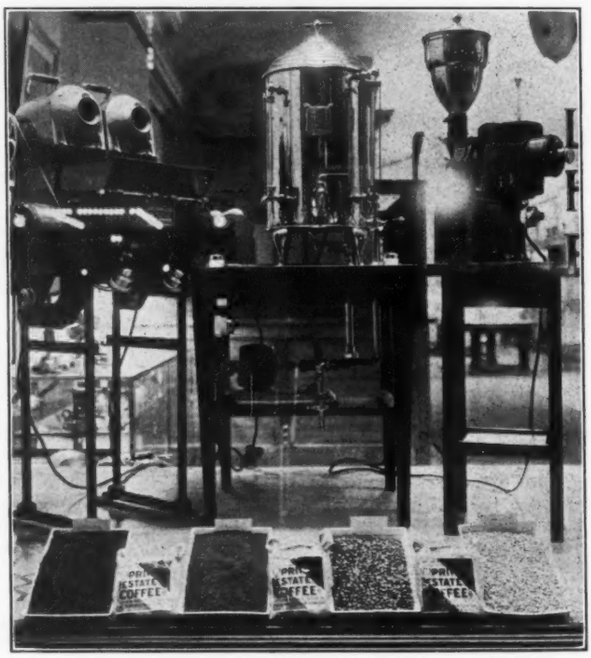
## Results of Two Years of Motor Leasing by Group of New England Companies

One of the first central-station organizations in New England to make a thorough trial of motor leasing was that of C. D. Parker & Company, Inc., of Boston, Mass., operating a number of properties in west-central and southeastern Massachusetts. The new-business department of this concern became convinced about two years ago that by a carefully worked-out leasing system many motors once installed would be retained in service and that the capital cost of furnishing motors might be safely carried on a rental basis. Experience has proved the correctness of these views.

In two years twenty-nine installations have been made, aggregating 1436 hp. The investment complete is $28,344, including mechanical equipment required. The yearly revenue from energy sold to these installations is $24,746, and the yearly rental is $4,252, a total of $28,998. Seven "prospects" have now refunded $5,997, leaving a balance of $22,347, on which the central-station management is receiving 15 per cent rental, subject to reductions in the principal. In addition to the leased power, 1142 hp. of other motor business was connected during the period, the owners paying for their own installations. Care must be taken to execute a thoroughly prepared lease, with record thereof, insurance of motors, etc. Concerns on the verge of bankruptcy have been supplied with motors on this plan, the ownership being vested in the central station. In one instance where the concern failed and new owners came to the mill the central station would not have secured the service had its installation not already been in place, as the owners were prejudiced against purchased energy.

## Putting Human Interest Into the Show Window

This picture of a window display recently featured in the Edison Shop by the New York Edison Company shows how well, with a little effort, a stray element of human interest may be injected into a display of apparatus that otherwise could hardly hope to win the attention of the passers-by. This window contained an



A SHOW WINDOW TO INTEREST THE PASSER-BY IN THE APPLIANCE DISPLAY WITHIN

electric coffee roaster, an electric urn and a motor-driven coffee grinder. These are all mechanical objects with little appeal to the eye, but by the introduction of the trays of coffee raw, roasted in the bean, ground and pulverized, with the sacks of coffee in between, a note of interest was immediately aroused. The cards on each tray gave information that explained the application of the electrical apparatus, and a young woman demonstrator was in attendance to receive all who might be sufficiently interested to come inside.

## Electric Ash-Cart Sprinkling Trucks at Lynn, Mass.

The city of Lynn, Mass., has recently purchased two electric chassis, of 5 tons capacity each, equipped with apparatus for sprinkling the streets during the season when that service is required.

For winter use the tanks are removed and dumping bodies substituted, the trucks being in service for col-

lecting ashes and removing them to the public dump. Each truck is considered the equivalent of three double and two single teams in either service.

The tanks are 13 ft. 10 in. long, 4 ft. 6 in. in diameter, and have a capacity of about 1200 gal. each. The sprinkler equipment enables them to flush a street 50 ft. wide by the use of one nozzle and 85 ft. wide with two nozzles, under pressure from an air tank 2 ft. long at the end of the main tank, operating under 60 lb. per square inch. The water discharge is controlled through lever gate valves operated by hand from the driver's position. The two brass flushing nozzles have uniform action and can be worked independently or together.

Batteries are charged on the chassis frame. The controller, meter, safety switches and fuses are installed under the waterproof hood in front of the dash. The vehicles have solid rubber tires, 36 in. by 6 in., guaranteed for 8000 miles. The rear tires are dual.

Charging and garaging are performed by the Lynn Gas & Electric Company at its station garage. Figures of energy consumption and mileage for the months of June and July are available and are as follows, for both vehicles: June, 1255 miles, 1705 kw.-hr. consumed; July, 1237 miles, 1503 kw.-hr. consumed; average energy consumption per mile traveled, 1.28 kw.-hr. The vehicles, which are equipped with Philadelphia lead batteries, were built by the General Motors Truck Company, Pontiac, Mich.

# Across the Buyer's Desk

## How a Purchasing Agent Views the Electrical Salesmen Who Come to Sell Him Goods

BY GEORGE R. JONES,

Purchasing Agent Public Service Company of Northern Illinois, Chicago.

NOTHING does a salesman more good than a glimpse of himself as his customer sees him. Sometimes it brings a disillusionment. Perhaps it also hurts the pride a bit, but nevertheless it is a stimulant to every man who is really eager in his work and his ambition to make good. So I am going to picture just a few of the many types of salesmen who besiege the door of every purchasing agent and by thoughtless, mistaken attitudes defeat the very object of their visit.

The impressions that a purchaser gets of the world of human nature as typified by the salesmen who call upon him are many and varied, for the army of the order takers is indeed a motley array. Many psychological mistakes are still made, in spite of the noble work being done by the business educators to make the purchaser a puppet in the hands of the selling expert. Yet the average purchasing agent is willing to try his hand with all comers, I think, and wants to see every one who really wants to see him. It is educational. For instance:

Mr. Raw of the Raw Material Company is brought in. Mr. Raw has the air of a man who has just secured his job and wants to make a big haul the first day, and so selects a large company. Mr. Raw comes in a trifle awkwardly, but he has a cigar in his hand which is going to do the heavy work for him, and he feels quite confident. Rather than keep you in suspense, he hands it right over before he says a word of business. This is an oft-repeated little tragedy.

There is another kind of salesman that the purchasing agent comes in contact with. He is one of the best friends you ever had, but never discovered it until he saw your name in a list of prospective buyers of his material. His factory is in the East, but he has been selling to people all around you for years, and he can't see how he has overlooked you. He is an affable fellow and comes in with an extended hand and a very, very beaming smile on his face, shakes hands and slaps you on the back at the same moment, leaves the "mister" off at the start, knows all the other men in the industry, and is ready for that carload order inside of five minutes. Like the man who has no music in his soul, this man is fit for stratagems. The particular form of strategy which the purchasing agent uses with him is to make him think he is going to get an order and then keep him waiting. It may be cruel, but certainly it is human.

Another type of salesman is the man who overstudies his victim. He casts about sedulously for something to interest you—tries to discover your hobby. The trouble is he is more persistent about your hobby than he is about your order, and by the time he gets down to business you have an appointment with the next man.

Again, there is the fellow who does not know the sublime from the ridiculous. He comes at the wrong time and leaves at the wrong time. He is the kind that hangs around to see you personally on an important matter when you are dictating a pressing report for the boss, and when you finally let him in he tells you there is going to be another 5 per cent drop in lock-nuts.

Then there are always those, of course, who claim to be personal friends of some man "higher up." Sometimes that is the reason for their going into the business. These people cannot understand the possibility of any other motive for you to act on when placing your order.

And what can be said of the man who brings his competitor's material with him in order to point out its faults? First, that he is no gentleman, and, second, that these tactics have never yet helped any salesman. And if a salesman wants to play a strong card for his competitor's goods, he should be told this is the right course to pursue.

### Winning Him with Honors

But these are common, trivial incidents. Now let us gaze upon the picture of the gentleman, sales manager perhaps, who thinks he is the most important piece of business in the world. He tells his amanuensis some bright morning to get you on the line. When the bell rings you answer, in your effort to save time, "Smith talking."

"Is this Mr. Smith?" she asks.

You say, "This is Smith."

"Just a moment; Mr. Highboy wants to speak to you."

After a few moments "Mr. Highboy" is on the line.

"Good morning, Smith," he says. "Mr. Higherboy is on from the factory to-day, and I should like to have you join us in a little lunch. Will you meet us at Delmonico's at 1.15?"

Note the fancy place and the fancy hour. As you don't like to be rude to Mr. Higherboy, you say "Yes."

When you arrive at the appointed hour a colored gentleman takes your hat and ushers you to the table which brings the highest premium in the room. The repast before you has been thought over for a week and

is calculated to impress you with the modesty of the man who asked you to a little lunch. Cocktails are in double-sized glasses; new-fangled dishes are brought on which only a ten-thousand-dollar chef would venture to concoct; imported wines are served. But it is beneath Mr. Higherboy's dignity to talk business at a little lunch, and so he talks about himself. This is the kind of a sales manager to whom his competitors can afford to pay a generous salary.

Unfortunately we have still among us, though the type is disappearing, the man who lets you know in one devious way or another that he is willing to pay you well for giving him the business. To denounce this man as a briber to his face is not enough; he should be reported to all other purchasing agents and blacklisted through some such machinery as the hotels have for reporting hotel thieves. Graft such as the purchasing agent meets is of two kinds—ordinary graft and innocent graft. For in the latter category fall those many petty offerings on the shrine of commerce that are practiced even in this highly moral day. Probably a cigar has looked alluring to every purchasing agent at some time of his life, but after he has been on the job awhile the experience of receiving a cigar becomes so dulled that it is just about as exciting as getting a laundry bill. Some day I hope it will be a capital offence for a salesman to offer a purchasing agent a cigar. Under the same head comes the fallacy of Christmas giving from the seller to the buyer Some companies think it incumbent upon them to give away Christmas presents to their customers. This may still be all right with some small customers in small towns where the gift is looked upon merely as a pleasing compliment, and yet I doubt it. Surely it is all wrong when it comes to the man who is not spending his own money, and doubly so because the gifts usually vary in cost with the size of the business. In the first place, it is wrong to take this money out of the pockets of the owners of the selling company. It represents legitimate earnings and does not belong to others. In the second place, it is not fair to the purchasing agent to give him Christmas presents, because it makes it hard for him to overlook these things in trying to play fair with the other fellow. And it creates, besides, a wrong impression among the clerks and assistants in the purchasing office, which impression does not breed impartiality. Not one of these selling companies will admit that the box of cigars, the silver umbrella or the merchandise certificate on Marshall Field & Company is intended to influence future business, but that is the effect it has, all the same, and it should therefore be stopped. A card or letter expressing the good wishes of the sender or the compliments of the season shows both better taste and better ethics, and I am glad to say that I know one large company which has sent out written notices that nothing more than these will be accepted by its purchasing department at Christmas time.

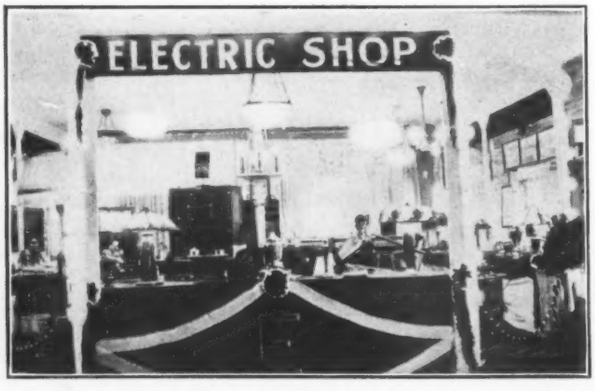
### The Other Kind of Salesman

I would not like to leave you with the impression that the purchasing agent sees nothing but freaks. On the contrary, the great majority of men who come to sell goods to him are good, full-blooded Americans and men he is glad to shake hands with. They come in, say one pleasant word and then present their business. If there is anything they can do to make their proposition more clear, they do it. If there are any impartial facts to be had on the subject at issue, they give them. They know you are busy, but don't flatter you by telling you so. They simply leave when it is time.

You sometimes hear people talk of buyers and purchasing agents synonymously, yet there is a distinction. A buyer's duty is to dicker for a price, and the lower the price at which he gets his material the better the buyer. His is a more or less mechanical business, but the purchasing agent has an unlimited field of study always before him—the trend of markets, financial conditions leading to overproduction or underproduction, the study of substitutes, the products of the big industries and the small industries. These things the purchasing agent should keep in touch with. I say "in touch with" because it is almost impossible for a man to be an authority on more than one subject, and if he is an authority on even one other subject he should not be a purchasing agent. It is no wonder, then, that with this program in front of him the purchasing agent cannot go into every subject presented by the salesman as closely as the salesman would like to have him, for the mere dispatch of his business is a difficult problem. His aim is to do justice to each salesman in proportion as he sees the importance of the subject presented. The situation therefore demands constant self-education, that he may approach efficiency in his position of purchasing agent, and he is lucky who is gifted with good judgment to mix with what knowledge he has.

At the same time every salesman should appreciate that, after all, his proposition must be weighed and balanced on its economic merits or it cannot long prevail. It is better for him to forget his "dope" on "salesmanship" and confine himself strictly to business, keeping in mind the fact that, after all, the purchaser sees just about as much of human nature as the salesman does himself, and that by the time the salesman has "sized up his man" the purchaser has probably just as surely sized him up also. A straight-line argument is the shortest distance to a purchasing agent's order file.

---




## Electric Kitchen a Feature During "Made-in-Janesville Week"

During "Made-in-Janesville Week" the Janesville (Wis.) Electric Company located many prospective customers through its demonstrators at the "Electric Shop" booth. An electric kitchen and an electric laundry were the features of the exhibit. The woman demonstrator employed in the electric kitchen was able to interest visitors in electric cooking by serving cup-cakes and percolated coffee prepared electrically "on the spot." Lamps, vacuum cleaners, irons, heaters, stoves, ranges, percolators, toasters and other appliances composed the company's display in the booth, which was made under the supervision of P. H. Korst, secretary and treasurer of the Janesville Electric Company.

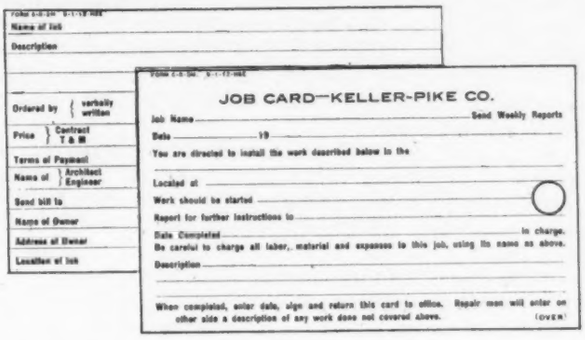

Name of Job
Description
Ordered by
Price
Terms of Payment
Name of
Send bill to
Name of Owner
Address of Owner
Location of Job
JOB CARD—KELLER-PIKE CO.
Job Name
Send Weekly Reports
Date
19
You are directed to install the work described below in the
Located at
Work should be started
Report for further instructions to
Date Completed
in charge.
Be careful to charge all labor, material and expenses to this job, using its name as above.
Description
When completed, enter date, sign and return this card to office. Repair man will enter on other side a description of any work done not covered above.
(OVER)

FIG. 1—ORDER AND JOB CARDS, MADE OUT IN ADVANCE

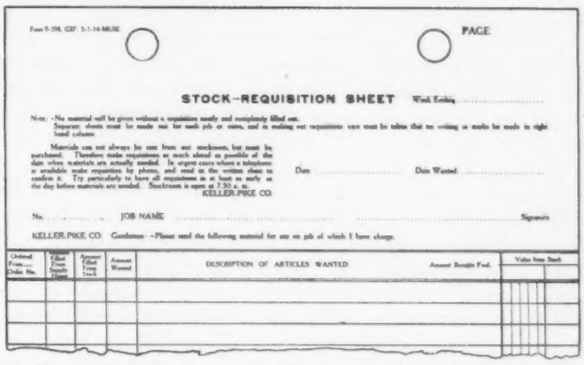



FIG. 2—REQUISITION SHEET FOR CONSTRUCTION MATERIALS

# Bookkeeping and Cost-Keeping for Electrical Contractors

BY LOUIS W. MOXEY, JR., VICE-PRESIDENT KELLER-PIKE COMPANY, PHILADELPHIA

IN order to obtain figures on costs such as are given in the tables of the previous two installments of the present series of articles (see ELECTRICAL WORLD, Oct. 16 and 23), it is necessary for the contractor to employ such cost-keeping and bookkeeping systems as will not only enable him to obtain a general idea of the cost of doing business but will allow him to determine also the unit costs of performing the various operations entering into the execution of any wiring contract. Unless a contractor does employ such cost-keeping and bookkeeping methods, he can hardly be said to be engaged in business, for he is merely playing a game of chance with his entire investment and business future as the stakes.

Many methods of cost-keeping and bookkeeping are, of course, in use by electrical contractors. Some lack merit and others are of great usefulness. In designing any cost-keeping and bookkeeping system it should be borne in mind that the simpler the system can be made the more satisfactory and efficient it will prove to be, provided that it gives all the information that the contractor should have about his business.

The system of cost-keeping and bookkeeping to be described is the one employed by the firm with which the writer is connected. This system has been found very satisfactory and requires the minimum of labor.

Upon the receipt of an order for performing a certain piece of work, an order card (Fig. 1) is filled out and turned over to the credit department, where the rating, financial responsibility, etc., of the prospective customer is examined. If the result of this inquiry is satisfactory, the card is passed to the bookkeeping department, where the information contained on the card is entered in the contract ledger and the card filed in the order-card index file.

In the contract ledger, under the entry for the job, are charged all labor and material actually used on the job until the work is completed, no entry being made, however, for office expense.

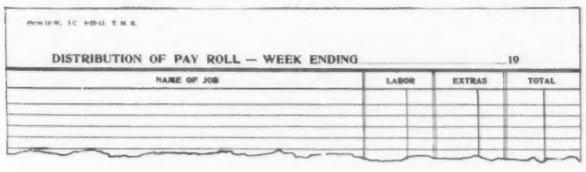



FIG. 3—SHEET FOR PAY-ROLL ACCOUNTING

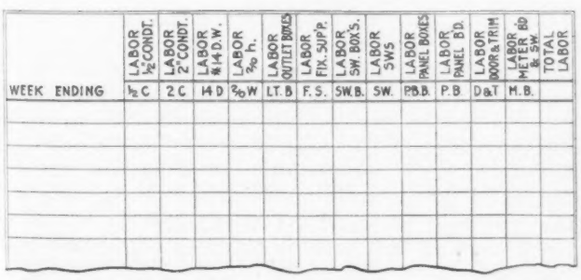



FIG. 4—SYMBOLS FOR LABOR ITEMS ON PAY SHEET

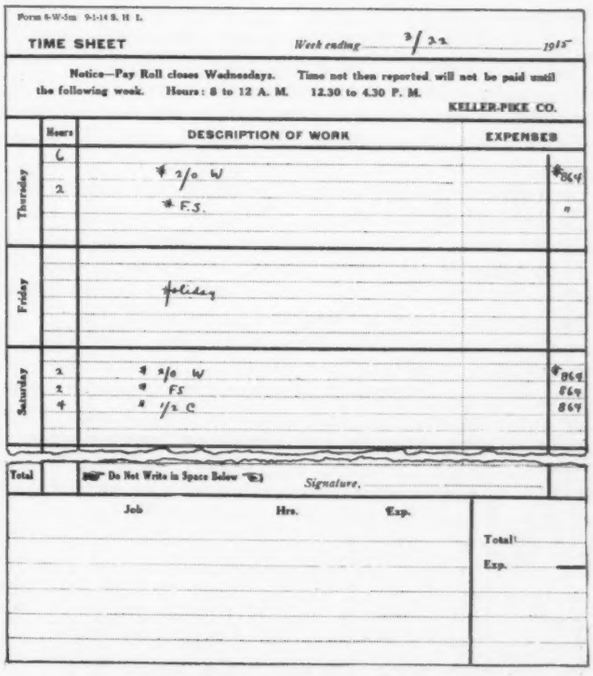



FIG. 5—LABOR RECORD COMPILED BY CLERK

After the plans and specifications for the work are received the engineering department lays out the work, straightens out any discrepancies between the plans and the specifications, and secures any other information which may be necessary for the construction department to know before proceeding with the actual work. The plans and specifications are then turned over to the construction department, the superintendent of which fills out a job card (Fig. 1) with the name of the man who has been selected to be foreman of the work. The card then becomes the foreman's order for the work and is kept by him until the completion of the job. When the card is returned, the bookkeeping department knows the job has been completed and is ready for billing. This process is repeated in the case of any extra work which may be ordered by the customer, no foreman or workman being permitted to do any extra work on a contract until a job card for the same has been issued.

When the construction department starts a piece of work the superintendent fills out a stock-requisition sheet (Fig. 2). To guide him in ordering materials a copy of the estimate showing the estimated amounts of materials needed is also given him. Upon the receipt of the material at the job a second list is filled out on a special receipt form and receipted by the man in charge. After a job is completed, the surplus material is again listed and returned to the stock room. The receipt of material in the stock room is entered on a sheet similar to the first bill of materials, but containing the words "stock room" in the place of "job." Sheets such as those described are also filled out by the foreman in charge when material is transferred from one job to another and does not pass through the stock room.

By referring to the stock-requisition sheet (Fig. 2), it will be noticed that the amount of material desired is placed in the fourth column from the left, the amount of that material supplied from the stock room in the next column, and in the adjoining two columns the amount of that material furnished by any local supply house, together with the initials of the supply house and the contractor's order number to the supply house. All material going to a job is, therefore, entered, but only that portion of the materials supplied from the stock room is valued on the sheet, the amount being credited to the stock room and charged to the job. The material furnished by the supply house is billed by the supply house, whose account in the main ledger is credited and the amount charged in the contract ledger. The list of materials received at the job becomes, therefore, the bookkeeping department's "sheet of original entry," and these sheets are filed in an indexed loose-leaf ledger. The other material sheets mentioned are, on the other hand, simple memoranda for checking and receipts for materials.

To charge the stock room and credit a job on the return of materials, or to credit one job and charge another where materials have been transferred without passing through the stock room, a sheet similar to the requisition form, but of different color, is filled out in the office from the data contained on the other types of material sheets mentioned.

The bills for work done can be made out readily, the price being already established. In time-and-material work it is necessary for the billing clerk to refer to his contract ledger and copy down all material and labor items which have been charged to the work, giving the price at which the same were charged and noting whether the material was furnished from the stock room or from a supply house. This bill is made out in pencil and turned over to the construction department, by which it is examined and, if found correct, passed to the person pricing the material and labor.

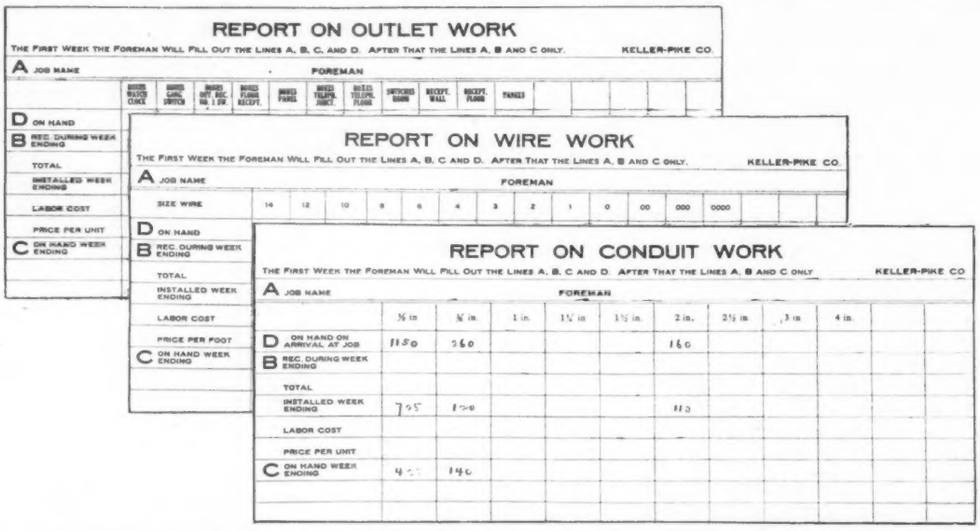

REPORT ON OUTLET WORK
THE FIRST WEEK THE FOREMAN WILL FILL OUT THE LINES A, B, C, AND D. AFTER THAT THE LINES A, B AND C ONLY.
KELLER-PIKE CO.
A JOB NAME
FOREMAN
D ON HAND
B REC. DURING WEEK ENDING
TOTAL
INSTALLED WEEK ENDING
LABOR COST
PRICE PER UNIT
C ON HAND WEEK ENDING
REPORT ON WIRE WORK
THE FIRST WEEK THE FOREMAN WILL FILL OUT THE LINES A, B, C AND D. AFTER THAT THE LINES A, B AND C ONLY.
KELLER-PIKE CO.
A JOB NAME
FOREMAN
SIZE WIRE
14 12 10 8 6 4 3 2 1 0 00 000 0000
D ON HAND
B REC. DURING WEEK ENDING
TOTAL
INSTALLED WEEK ENDING
LABOR COST
PRICE PER UNIT
C ON HAND WEEK ENDING
REPORT ON CONDUIT WORK
THE FIRST WEEK THE FOREMAN WILL FILL OUT THE LINES A, B, C AND D. AFTER THAT THE LINES A, B AND C ONLY.
KELLER-PIKE CO.
A JOB NAME
FOREMAN
½ in. ¾ in. 1 in. 1¼ in. 1½ in. 2 in. 2½ in. 3 in. 4 in.
D ON HAND ON ARRIVAL AT JOB 1180 960 160
B REC. DURING WEEK ENDING
TOTAL
INSTALLED WEEK ENDING 795 1120 115
LABOR COST
PRICE PER UNIT
C ON HAND WEEK ENDING 140

FIG. 6—WEEKLY TIME AND MATERIAL REPORTS TO BE FILLED IN BY THE FOREMAN

The distribution of the labor on various jobs is made by the pay-roll clerk on a pay-roll sheet (Fig. 3), and the various jobs are charged and the cash account credited from this sheet.

When a contract is secured in which the unit price of labor for certain parts of the work is not accurately known to the contractor, this information being desired for future use, he should endeavor to obtain these data by having a sheet such as shown in Fig. 5 prepared for his pay-roll clerk. A copy of this sheet should be given to the foreman on the job with instructions to mark his time sheets according to the symbols for the labor items as shown in Fig. 4.

At the end of the week the pay-roll clerk inserts on his unit-cost sheet the amount of money expended during that week for the various labor items on the job under way, the total of these items equaling the total pay-roll for that job. This process is carried on until the completion of the work, at which time the total labor for each item is ascertained. Dividing the total labor for installing a certain material by the total amount of the materials installed, as ascertained from the contract ledger, a unit price is obtained for installing that material.

It is very often desirable, however, to know what the

unit price of labor is at the end of each week, especially if the job is some distance from the contractor's office and is visited by his superintendent only once or twice during the progress of the work. This can be accomplished by the use of time sheets (Fig. 6) issued to the foreman. Taking, for example, the report on conduit work, the foreman fills out the lines marked A, B, C and D for the first week, after which only the lines A, B and C are filled out.

The line A designates the job. The line D, which is filled out only when the first slip is issued, indicates the amount of conduit on the job at the time the foreman arrives, while the line B, which is filled in by the foreman every week, indicates the conduit received during that week. Now, the line C, which is filled out by the foreman every week, indicates the amount of conduit on hand at the end of the week. Hence, the sums of the amounts of materials entered on the lines B and D minus the amounts entered on C, that is, B + D — C, for the first week indicate the amounts of the different sizes of conduit installed during that week.

After the first week the sums of the amounts of conduit along the line D of the first week's report and along the line B of all subsequent weekly reports, minus the amounts along the line C of the last report, indicate the amounts of the different sizes of conduit installed up to the time of the last report.

The labor costs from the weekly time sheet (Fig. 4) are then inserted along the line marked "labor cost," and the unit prices are accurately figured and placed along the line marked "price per unit." If the price per unit for any item is higher than the estimated price, the head of the construction department indicates this by placing a red cross opposite the particular item to which he desires to call the attention of the superintendent. The latter immediately investigates the matter, reporting on any possible causes for the increased costs and on the possibility of reducing the unit price.

This same process is carried out for wire work and outlet work. In the usual installation these items of conduit work, wire work and outlet work are by far the largest portion of the labor item, so that the work on signal systems, bells, etc., can be neglected. Otherwise the cost involved for ascertaining unit prices on the minor work would far overbalance the benefits of knowing these particular labor costs.

# Technical Advance in Theory and Practice

*Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World*

## CONTROLLING INFRA-RED EMISSION

### Increasing the Luminous Efficiency of Incandescent Solids by Reducing the Output of Wave-Lengths Outside the Lower Limit of Visibility

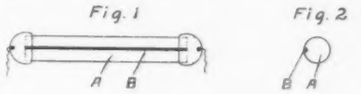
BY W. W. COBLENTZ

It is a well-known principle of physics that solid substances in an incandescent state emit a large amount of infra-red radiation. It is generally recognized that in order to produce a high output of luminous radiations from such a solid substance it is necessary to operate it at a high temperature and to prevent the production of useless infra-red radiations. Energy input (whether it be electrical energy or the combustion of a gas) and radiant energy ("visible" and infra-red) output are correlated. If the dissipation of energy in the form of infra-red radiations is prevented, then the temperature required for the production of visible radiations can be maintained at a lower energy input than is ordinarily experienced.

About nine years ago, while engaged in an investigation of the emission spectra of solids, I found that in many substances, especially mixtures, the infra-red emission spectrum, which is discontinuous at low temperatures, becomes continuous at high temperatures. At that time I was interested mainly in rendering the substance electrically conducting, so that it could be heated to incandescence and its emission spectrum examined. As the work progressed it was observed that by fulfilling certain conditions the infra-red emission spectrum of a highly incandescent solid remained discontinuous and deeply indented, just as was observed at low temperatures. This was exactly the opposite from what I had observed previously on the Nernst glower. The practical application was at once evident. In order to keep the emission spectrum discontinuous one must proceed in a different manner in making a glower—whether it be heated electrically or whether the material be in the form of a gas mantle.

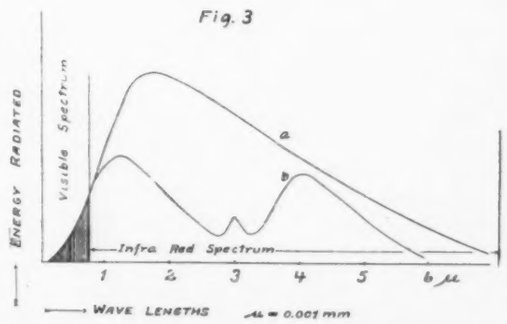
The fundamental difference between the present method for producing light and previous methods, by means of second-class conductors, lies in the selection and the treatment of the constituents of the radiator, so that it may emit the maximum amount of light with a minimum production of infra-red rays. The procedure is set forth in Letters Patent No. 1,135,663, April 13, 1915.

For a long time it was not admitted by the examiner that solids can emit banded spectra, that supposedly being a property of gases only. Those in doubt about the matter are referred to Publication No. 97 of the Carnegie Institution of Washington, pages 86, 96, etc., 1908, and to the *Bulletin* of the Bureau of Standards, Vol. 6, page 301, 1909.










FIGS. 1 TO 3—PATENT DRAWINGS FOR COBLENTZ GLOWER

The present invention is still necessarily in a developmental stage, and the materials now used are not necessarily those that will bring ultimate success. The light-producing part of the glower of my invention consists of a thin thread of a complex aluminum silicate

which is attached to a thin rod of aluminum oxide for a support. For a gas mantle the material may be used in a simpler form.

The principles involved are as follows: (1) the use of a thin layer of a substance which can be operated near its melting point (which must be high) without evaporation, and (2) as such a thin layer cannot be so operated without melting and forming an arc, the combination of this material with a support in such a manner that the infra-red emission spectrum of the combination remains discontinuous even at the highest operating temperatures. The glower of the present invention fulfills these two conditions, and it is believed that, for the first time, we have something which approaches the long-sought-for goal of controlling the manner in which heat and light waves are emitted from a solid substance, and thereby controlling the luminous efficiency of the substance.

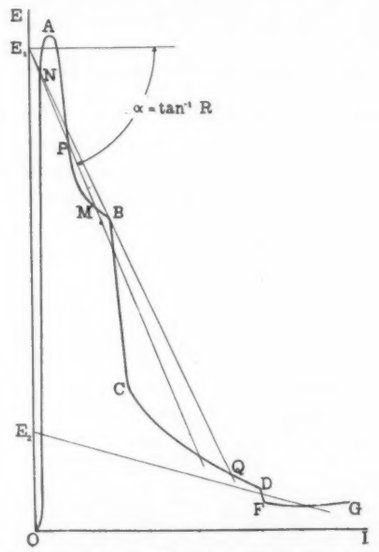
[For a full understanding of the preceding article of Dr. Coblentz, we reproduce Figs. 1 to 3 from his patent No. 1,135,663 (April 13, 1915). Fig. 1 shows a glower consisting of a thin thread *B* of feldspar, joined to the more refractory and less conducting base of aluminum oxide *A*. Fig. 2 is a cross-section of the glower. In Fig. 3 the curve *a* gives the distribution of energy in the spectrum from a highly incandescent ordinary glower, while curve *b* gives the distribution of energy in the spectrum of the Coblentz glower. The indentations in curve *b* vary somewhat with the composition of the glower. For example, the band at about 3μ (μ = 0.001 mm.) is owing to silicates. Since the areas under curve *a* and under curve *b* are a measure of the energy input, it is evident that for the glower *b* the energy input required to produce the same radiation within the visible spectrum is much less than for glower *a*, as the useless infra-red radiation is reduced.—EDS.]

### Generators, Motors and Transformers

*Dispersion Coefficient of Three-Phase Induction Motors.*—E. A. BIEDERMANN.—The first two installments of a long paper in which the author first deals with a method of calculating the dispersion coefficient of a three-phase induction motor. It is divided into five sections. The first section shows how the dispersion coefficient may conveniently be separated into three components, termed the main, peripheral and flank dispersion, and how these components may be expressed in terms of the coefficients of self and mutual induction of the stator and rotor windings. Sections 2, 3 and 4 are devoted to the calculation respectively of these three components in terms of the dimensions of the machine, particular attention being given to the component termed the main dispersion. In section 5 comparisons are to be made of the dispersion coefficients, calculated in the manner described, with those obtained experimentally. In the second part of the serial the results obtained in the first part are to be applied to the question of the design of a motor from the point of view of obtaining a minimum dispersion coefficient. It is shown that for this purpose a small slot pitch is as important as a small air-gap, and a method of design is outlined beginning with the slot and resulting in fixing the diameter of the machine. It will then be discussed to what extent the dispersion coefficient is likely to be increased if this diameter is departed from. The serial is to be continued.—London *Electrician*, Oct. 15 and 29, 1915.

### Lamps and Lighting

*Unstable States in Arc and Glow.*—W. G. CADY.—A paper read before the New York Section of the American Electrochemical Society. The author discussed the characteristics of the gas discharge. The cut shows qualitatively the relation between current and voltage in the discharge between two fixed electrodes. The nature and pressure of the surrounding gas are supposed constant. The first part of the curve *OA* represents the saturation current, which soon assumes a value that is practically constant over a great range of voltage. This current is carried by the few free ions that are always present. As the voltage increases, the charged particles are sufficiently accelerated to form new ions by impact. At this point the current begins to increase, and a faint glow appears. The point *A* represents the "sparking potential." In the present case the external resistance is supposed to be too high to admit of sparking. *AB* is the glow discharge proper, in which the rate of ionization is so great that the voltage across the gap begins to drop. If the cathode is small, the curve may rise again before *B* is reached, owing to the abnormally high cathode drop. Since the drop at the cathode is much larger than that at the anode, the cathode becomes relatively hot. As *B* is approached, the expenditure of energy at the cathode becomes so high that the cathode rapidly becomes incandescent. Here a new phenomenon appears, namely, the emission of electrons from the hot cathode, according to Richardson's law. These greatly increase the ionization close to




RELATION OF CURRENT TO VOLTAGE IN DISCHARGE BETWEEN FIXED ELECTRODES

the cathode, and the positive ions thus produced heat the cathode by impact still more. If the cathode metal is volatile enough, it begins to vaporize, thus lowering the cathode drop as well as the resistance of the gas. The discharge quickly resolves itself into an arc, in which the negative base is concentrated to an intensely bright spot, the current is carried chiefly by the vapor from the cathode, but the mechanism of the discharge is essentially as before. The portion *BC* of the curve cannot be observed. Over *CD* the discharge is an arc as far as the cathode is concerned, but, since less energy is being expended at the anode, at the latter we may still have a glow discharge. The positive base of the discharge is undefined and faintly luminous. This is the first stage of the arc. With increasing current the anode is brought to the boiling point. This causes a decrease in the anode drop and a further increase in conductivity of the gas, so that the portion *DF* is quickly passed over. *FG* is then a full arc or second-stage arc.

Quantitatively it is impossible to make the diagram give a correct idea of the voltage and current relations, since the current at $G$ is in reality many thousands of times greater than at $A$. As Kaufmann has shown, the diagram gives a simple criterion of the stability of the discharge. Let the supply emf. be measured by $OE_1$ in the cut. If $M$ is the point on the curve at which the discharge takes place, then since the ordinate of $M$ is the voltage consumed by the discharge, the external resistance $R$ is equal to tan $\alpha$. If $R$ is decreased, $\alpha$ must decrease and $M$ will move to the right along the curve. A stable discharge is only possible when the line through $E_1$, or the "resistance line" as it is called, slopes more steeply than the characteristic curve at the point in question. Thus the discharge is stable at $M$, and, starting with zero current, it would also be stable at $N$ with the same external resistance, but not at $P$. A glow at $P$ could only be obtained with an enormously high emf. At $B$ the discharge is unstable. The author then discusses the carbon arc and its first and second stages, the effect of impurities, and the question whether an arc is possible from a pure metal. He then deals with intermittent discharge, corona discharge, rotations at the anode and glow arc oscillations, and takes up the singing arc and its application in radiotelegraphy. The effect of the second harmonic is finally discussed. With respect to practical conclusions for stability, an arc should be operated with supply emf., external resistance and current all large. Or if the discharge is to be a glow, a region on the characteristic should be chosen at a safe distance from a critical point, having due regard to the supply emf. For oscillations a steeply falling characteristic, small current, large emf. and artificial cooling of the electrodes are important factors.—*Met. and Chem. Eng'ing*, Nov. 15, 1915.

### Generation, Transmission and Distribution

*Substations of the Sydney Electricity Supply.*—A note taken from a paper by J. E. Just giving the following details of the substation apparatus of the Sydney municipal electric supply undertaking. High-tension three-phase currents at 5000 volts are converted by rotary converters, motor converters and synchronous motor-generators to direct current at 240 and 480 volts on the three-wire system. The two largest sets for this purpose are 15,000-kw. machines, one a motor converter and one a rotary converter. This variety in the kind of apparatus employed is largely due to the necessity of controlling the station power-factor. The complete remote control of substations may be put into operation by the tramway department. Batteries are also used, there being two, of 4000 amp.-hr. and 6000 amp.-hr. rating at the one-hour rate. Great care has had to be taken in supporting the conductors for such large batteries, as great magnetic forces may be set up between them. The batteries are in halves between the outers and the neutral, and when charging the booster is connected in between the halves. The static transformers range from the large 33,000-volt apparatus in brick substations to small exposed transformers on poles, the latter type running to 200 kva. An interesting piece of apparatus in this connection is a special portable oil drying and filtering outfit, enabling the oil of a transformer to be dried out while the transformer is still in service, the oil being circulated through the filter and back to the transformer. The cost of drying in this way is about 26s. ($6.50) for a 100-kva. transformer containing 130 gal. of oil.—London *Electrician*, Oct. 29, 1915.

### Traction

*Electrification of British Railway.*—Continuations of a long illustrated article on the electrification of the London & Southwestern Railway. The present capacity of the power plant is 25,000 kw., in turbo-alternator units of 5000 kw., with room for a sixth set, but there is space between the present building and the cooling towers for an extension to double this power. Besides the generating plant and the boiler house the auxiliary plant external to the power house is described.—London *Electrician*, Oct. 22 and 29, 1915.

### Installations, Systems and Appliances

*Prepayment Meters in Amsterdam.*—W. LULOFS.—An account of the results obtained in the municipal central station of Amsterdam with the use of prepayment meters for the purpose of popularizing the use of electricity in small households. The installation, which is made free of charge to the consumer, consists of not more than eight "lighting points" and one contact for heating and power devices, such as electric flatirons, etc. To each "lighting point" an "unlimited number of lamps" may be connected. The installation is made for the municipal station by local wiring contractors at a fixed rate. If more lighting points or contacts for heat devices are wanted, the excess installation is made at the expense of the consumer, but it remains the property of the city. Two flexible cords, one ceiling lamp and three metallic-filament lamps of 50 cp. are furnished free of charge. A charge of 7.5 cents per kilowatt-hour is made for lighting and of 4.25 cents for power and heating, and the consumer must agree to pay yearly at least $4.25 for the first four lighting points and 42.5 cents for each further lighting point. The contact for power is counted as one lighting point. The price for lighting in Amsterdam for installations in which no prepayment meters are used is 6.25 cents per kilowatt-hour. The price of gas for lighting and power is 2.9 cents per cubic meter. The currents for lighting and power are measured by a single meter in such a way that the lighting current passes through two measuring coils in series while the power current passes only through one coil. The coils are so dimensioned that the counting device measures both currents in the correct proportion according to the tariff. A further reduction of cost is obtained by using one common house connection for several adjoining houses. The author compares the financial results obtained from prepayment meter installations with those obtained from energy supply to townships in the neighborhood. He finds that the prepayment meter installations give the most favorable results with respect to the ratio between capital invested and money received. It is found that the excess voltage at 1.25 cents per kilowatt-hour for lighting is fully sufficient to make the prepayment meter installations as profitable for the station as other installations. The first prepayment installations were made in February, 1914, and in August, 1914. The number of prepayment installations was 1239. In the average each installation has seven lighting points, the average candle-power of the incandescent lamps being 59, since a large number of 100-cp. lamps have been connected. The author has very high expectations for the success of this method of popularizing electricity.—*De Ingenieur* (Holland), Nov. 21, 1914; abstracted by H. Cahen in *Elek. Zeit.*, July 1, 1915.

*Storage Batteries in Alternating-Current Stations.*—L. SCHROEDER.—A long translation in abstract of his German paper, abstracted some time ago in the Digest, on tests of various methods employing storage batteries in alternating-current systems.—London *Electrician*, Oct. 22, 1915.

### Electrophysics and Magnetism

*Heat Conductivity of Selenium.*—L. P. SIEG.—The fact that selenium changes its electrical conductivity so markedly with illumination has no doubt led many investigators to consider the possibility of a change in its

heat conductivity with a change in the illumination. Bellati and Lussana, experimenting with a thin disk of light-sensitive selenium, found such a change and also noted that the percentage change in the thermal conductivity agreed well with the percentage change in the electrical conductivity where exposure was made to the same light. The present author, experimenting on a selenium crystal, found that while the given source of light increased the electrical conductivity nearly 300 per cent, the same light did not increase the thermal conductivity in any appreciable manner; considering all possible sources of error, it must certainly have been under 5 per cent.—*Phys. Review*, September, 1915.

### Electrochemistry and Batteries

*The Electrolytic Precipitation of Gold, Silver and Copper from Cyanide Solutions.*—G. H. Clevenger.—The conclusion of his long and profusely illustrated paper. In the present installment the author describes in detail the practice of electrolytic precipitation at San Sebastian, Salvador, at Virginia City, Nevada, at El Rayo, Mexico, and at Nelson, British Columbia, and deals with the disposal of byproducts of electrolytic precipitation, the construction of anodes and cathodes, and the cost of installation and operation.—*Met. and Chem. Eng'ing*, Nov. 15, 1915.

*Antimony.*—Anson G. Betts.—An American Electrochemical Society paper discussing various important points in electrolytic refining of antimony with a fluoride solution.—*Met. and Chem. Eng'ing*, Nov. 15, 1915.

### Units, Measurements and Instruments

*Reichsanstalt.*—An abstract of last year's report of the work of the Reichsanstalt. The numerous researches carried out related, among other things, to the theory of standard cells, the mercury resistance thermometer, the wave-form of electrolytic and mercury rectifiers, the thermal conductivity of metals, the experimental demonstration of Ampère's molecular currents, the thermal conductivity of bismuth in a magnetic field, the development of a simple method for testing voltmeters, the reflection of traveling waves at condensers and induction coils, induction effects on lines in the neighborhood, the passage of electric waves into a coil, the determination of "additional losses" in small induction motors, the measurement of large alternating currents, the distortion of the wave-form by the Lieben vacuum-tube amplifier, the use of the photo-electric cell as receiver in wireless telegraphy, the measurement of high inductions, iron-loss tests, etc.—*Elek. Zeit.*, Aug. 12, 1915.

*Testing Bureaus.*—Edelmann.—An article on the work of diferent testing bureaus in Germany in 1914. At the head of the electrical testing work in Germany is the Reichsanstalt, but there are testing bureaus also in Ilmenau, Hamburg, Nuremberg, Chemnitz, Munich, Frankfort and Bremen. The last three are in connection with the municipal central stations. There is also a large and independent testing bureau connected with the Physical Society of Frankfort. In all there were tested in 1914 in Germany in official bureaus 20,000 meters, of which 17,759 belong to systems which are admitted for official certification. Of these 16,425 received official certification, 2613 were admitted for use, and only 945, or 5 per cent, were refused approval. Notes are given on other test work, especially of materials, photometric measurements, etc.—*Elek. Zeit.*, July 22, 1915.

*Localization of Bullets by Radiography.*—F. Ozil.—An illustrated description of the Ozil method for localizing bullets by radiography. The same issue contains a description of the induction balance of A. de La Baume Pluvinel for searching for bullets in wounded bodies.—*La Revue Elec.*, Aug. 6, 1915.

# Book Review

Specification and Design of Dynamo-Electric Machinery. By Miles Walker. New York: Longmans, Green & Company. 648 pages, 533 illus. Price, $10.

The author's aim has been to produce a book which shall be of use to engineers who may have occasion, from time to time, to draw up specifications for electrical machinery. He endeavors to eliminate the non-essentials from the buyer's specification and lays stress on the points requiring special attention in order to comply with the requirements. The book is divided into two parts. Part I treats of the design of dynamo-electric machinery, mainly from the point of view of the practical designer. Part II contains a number of typical specifications relating to both alternating-current and continuous-current machines. These specifications are accompanied by numerical examples illustrating the manner in which a machine would be designed to comply with the terms of the specification. Professor Walker's method is based largely on the practice of the Westinghouse Electric & Manufacturing Company, but in the main it does not depart appreciably from the methods followed by most designers. Many useful rules and coefficients are given, based upon results obtained with modern machines of the best type. These, together with the excellent diagrams and curves contained in the first part of the book, cannot fail to be of great value to the practicing engineer. Some stress is laid on the fact that one fundamental formula is used for calculating the voltage generated in any type of dynamo-electric machine. The idea of the armature conductors cutting the flux in the air-gap is always present and the one formula is made applicable to all cases by introducing a coefficient the value of which depends upon the position of the conductors relatively to the pole faces and the space distribution of the flux in the air-gap. The chapters on ventilation and the predetermination of temperature rise are among the best in the book. The author treats this subject very clearly and well. The rules of design, with the many constants and formulas of use to the designer, are followed by a large number of model specifications with numerical examples. These include design sheets for continuous-current generators—belt-driven, engine-driven and directly coupled to high-speed steam turbines; three-phase generators (engine-driven and steam-turbine-driven), three-phase induction motors, rotary converters and a phase advancer. The book is excellent of its kind, one of the best treating of dynamo-electric machines since the publication of Hawkins and Wallis' classic treatise on the dynamo. It is too voluminous—and, in the reviewer's opinion, hardly suitable—for use as a text in technical colleges; but it will be invaluable as a book of reference for the electrical engineer, whether he be a designer or a user of electrical machinery.

## Books Received

Elementary Lessons in Electricity and Magnetism. By Silvanus P. Thompson. New York: Macmillan Company. 706 pages, 377 illus. Price, $1.50.

The Elements of Mechanics of Materials. By C. E. Houghton. New York: D. Van Nostrand Company. 216 pages, 94 illus. Price, $2.

PETER JUNKERSFELD

# *Men of the Industry*

Changes in Personnel and Position—Biographical Notes

**Peter Junkersfeld,** who was appointed chairman of the committee on operation of the recent conference on the proposed electrical safety code held at New York City, is assistant to the vice-president of the Commonwealth Edison Company of Chicago, a position which has large responsibilities in connection with the company's engineering work. Mr. Junkersfeld was graduated from the University of Illinois in 1895 and shortly afterward joined the operating staff of the old Chicago Edison Company. Advancing to the engineering department, he was in 1906 appointed electrical engineer of the company, and he has held his present post since 1909. Mr. Junkersfeld is a fellow of the A. I. E. E. and has been active in the work of the N. E. L. A., the A. S. M. E., the Western Society of Engineers, and other engineering organizations.

**Walter N. Polakov** has resigned as superintendent of power of the New York, New Haven & Hartford Railroad to engage in consulting practice. His address is Revonnah Manor, Stamford, Conn.

**Martin P. Coyne,** assistant superintendent of the Livingston-Niagara Power Company, Avon, N. Y., has been appointed superintendent of the company, succeeding Mortimer D. Gould, who recently resigned.

**James Cole Roberts,** formerly of the United States Bureau of Mines, Denver, Col., has been appointed to the Joseph Austin Holmes professorship of safety and efficiency engineering at the Colorado State School of Mines at Golden.

**George W. Lamke** has been appointed registrar of Washington University, St. Louis, Mo. Mr. Lamke was formerly instructor in the electrical school of Purdue University and was later with the Wagner Electric & Manufacturing Company.

**Alexander Russell** of Avon, N. Y., has resigned as treasurer of the Avon (N. Y.) Electric Company, Corporations Service Company, Livonia (N. Y.) Light & Heat Company, Lima-Honeoye Light & Railroad Company and Scottsville (N. Y.) Electric Light & Gas Company to devote his entire time to the Rochester & Lake Ontario Water Company, of which he is secretary-treasurer and director.

**George Chahoon** has been elected president of the Laurentide Company, Ltd., Quebec, Canada, succeeding the late Sir William Van Horne.

**Daniel Break** has resigned as general superintendent of the municipal electric-light plant and water-works system in Bridgetown, Ont., Can.

**Prof. L. L. Patterson** has been appointed professor of electrical engineering at the Mississippi Agricultural and Mechanical College, succeeding Prof. Clarence E. Reid.

**H. C. Borthwick,** office manager for the Meriden (Conn.) Electric Light Company, has been appointed secretary of the company, succeeding the late George M. Curtis.

**E. Lippe** has opened an office as consulting engineer in the Crilly Building, 35 South Dearborn Street, Chicago, Ill., and will specialize in the mechanical and electrical equipment of buildings.

**William J. Aicklen,** until recently commercial manager of the Consumers' Electric Light & Railway Company, New Orleans, La., has been appointed general manager of the company.

**Charles A. Roberts,** formerly commercial manager for the Ohio Service Company, Coshocton, Ohio, has joined the commercial staff of the Connecticut River Transmission Company, with headquarters at Norwich, Conn.

**R. S. Macey,** formerly of the General Electric Company, New York, has been appointed superintendent of the East Side municipal electric-light plant in Norwalk, Conn. Mr. Macey succeeds Elmer Lingard, who resigned nearly a year ago.

**Walter S. Dickson,** who for the last two years has been engaged in high-tension transmission work for the Chile Exploration Company, has now been appointed resident engineer for the Du Pont Nitrate Company at Officina Delaware, Chile.

**John F. MacLane** of Boise, Idaho, has been appointed general attorney for the Utah Power & Light Company, succeeding R. A. Wilbur, who goes to Cleveland, to become identified with the Herrick-Parmalee Company. Mr. MacLane has been prominent in legal practice in Idaho.

**Frank Harris,** who has for the last four and one-half years acted as publicity agent for the British Columbia Electric Railway Company, Ltd., with offices at Vancouver, resigned from the company on Nov. 1. Mr. Harris went to Vancouver from New York in 1904 and for several years served on the Vancouver daily press before taking up the post he has just relinquished.

M. R. HUTCHISON

**Dr. Miller Reese Hutchison,** chief engineer for Thomas A. Edison, has been appointed a member of the Naval Advisory Board by Secretary Daniels. Dr. Hutchison, who is thirty-nine years of age, was graduated from the Alabama Polytechnic Institute in 1897. During the Spanish-American War he was appointed chief engineer of the seventh and eighth districts of the United States Lighthouse Service and engaged in laying submarine cables and mines along the South Atlantic coast. He is the inventor of a motor-driven automobile horn and a device for aiding the deaf to hear.

**Myron W. Tenney,** who has been superintendent of the Newport Electric Light Company, Newport, R. I., ever since the company was organized, twenty-three years ago, has resigned. Mr. Tenney has been on duty almost continuously and will now take a well-earned rest.

**L. C. Eddy,** who held the position of director of the electrical department of the Shawinigan Technical Institute, Shawinigan Falls, Quebec, Canada, last year, has been engaged as assistant instructor in the electrical department at the Norwich University, Northfield, Vt. Mr. Eddy is a graduate of Brown University and took a general course in engineering at the Massachusetts Institute of Technology.

**C. E. Patton,** president of the Curwensville (Pa.) Light & Power Company, has been appointed Secretary of Agriculture of the State of Pennsylvania by Governor Brumbaugh. As a young man Mr. Patton engaged in the dry-goods business. Branching out, he dealt in coal and lumber and then took up engineering and contracting. Mr. Patton is also a successful farmer and has served two terms in Congress.

**J. L. S. Scadding,** who has been acting as superintendent of the Fort Madison (Iowa) Electric Company, has been appointed superintendent of the meter department of the Mississippi River Power Company at Keokuk, Iowa. Mr. Scadding was formerly a member of the Keokuk organization and has also served in the employ of the Tri-City Electric Company of Rock Island, Ill., the New York Edison Company, and the Virginia Railway & Power Company of Richmond, Va.

# New Apparatus and Appliances

*A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry*

## A Gaseous-Conductor Lamp for Color Matching

BY D. MCFARLAN MOORE

At a joint meeting of the American Electrochemical Society and the Illuminating Engineering Society held at New York on Nov. 11 Mr. Moore demonstrated his new carbon-dioxide vacuum-tube lamp, which employs a new principle for automatically replenishing the supply of gas within the tube as this gas is used up during the operation of the lamp. The application of the new lamp was also illustrated by showing the difference in the color values of objects such as dress goods, silks, meat and flowers when viewed first solely by the light of a standard tungsten lamp and then by the new type of Moore lamp. In the course of his talk, Mr. Moore called attention to the possibilities of the development of gaseous-conductor lighting and the limitations of solid-conductor lighting. Prof. W. G. Cady, Welsleyan University, Middletown, Conn., presented a paper on "Unstable States in the Arc and Glow," an abstract of which is given on page 1156 of this issue. A third paper, "The Electric Arc in Complex Vapors at Reduced Pressures," by W. A. Darrah, Mansfield, Ohio, was abstracted on page 1099 of last week's issue.

Elaborate spectrophotometric investigations have been made to show that articles of various colors, when viewed solely by the light of the new tube lamp illustrated herewith, have exactly the same shades of color which they display when viewed by the light from a clear sky. Dyers and other color experts thoroughly agree that the standard light which they wish for color judging is that which enters a window from a clear north sky at an angle of about 45 deg., and preferably about mid-afternoon with a clear sun shining in the south.

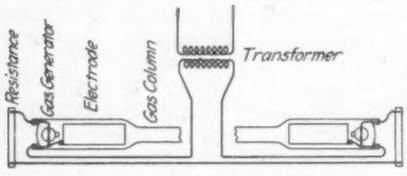



DIAGRAM OF CIRCUITS, SHOWING THE ARRANGEMENT OF RESISTANCES, CARBON-DIOXIDE GENERATORS, ELECTRODES, ETC.

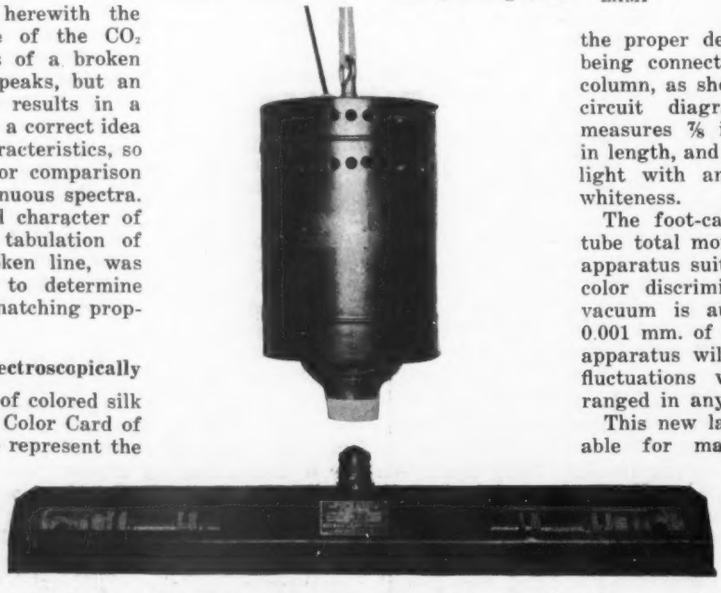
There is reproduced herewith the spectrophotometric curve of the $CO_2$ spectrum, which consists of a broken line with many jagged peaks, but an average of these peaks results in a smooth curve which gives a correct idea of the effective color characteristics, so that it should be used for comparison with other line and continuous spectra. The effect of the banded character of the $CO_2$ spectrum, the tabulation of which consists of a broken line, was thoroughly investigated to determine its relation to the color-matching properties of the lamp.

### Color Cards Examined Spectroscopically

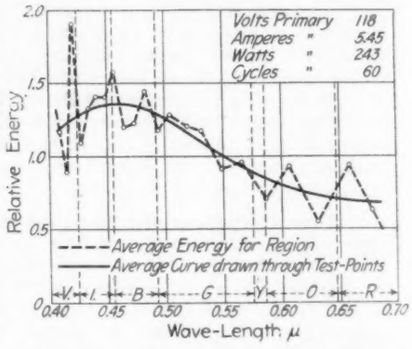
The following samples of colored silk taken from the National Color Card of America were selected to represent the various parts of the spectrum and were spectrophotometrically tested to determine what the actual color composition was: violet, National blue, Yale blue, emerald, lemon, orange and scarlet. The result of each of these tests was carefully plotted in the form of a curve, and a review of the data obtained in connection with these reflection curves showed that the irregularities in the $CO_2$ spectrum were absolutely without visible effect, and that they deviated only very slightly from north-sky values, to which they were compared. But it may be pointed out that if these north-sky values had all been taken at an angle of about 45 deg. there would have been no detectable variation, and that therefore the color-matching values of the $CO_2$ spectrum were all that could be desired.

### Details of Construction of Lamp

The accompanying illustration shows an exterior view of this new color-matching unit. The straight-tube lamp is contained in an elongated sheet-metal case, which, however, is provided with a screw base similar to that used on the larger sizes of incandescent lamps. Instead of the lamp being fed $CO_2$ gas by means of an auto-magnetic feed valve, the gas is generated automatically within the tube itself. Near each electrode is placed a small bulb about an inch long, containing calcium carbonate, from which emanates the carbon-dioxide, $CO_2$, when the resistance wires embedded in it become heated to the proper degree by reason of their being connected in shunt to the gas column, as shown in the accompanying circuit diagram. The gas column measures ⅞ in. in diameter and 1 ft. in length, and appears as a solid bar of light with an appearance of intense whiteness.



STRAIGHT-TUBE GASEOUS-CONDUCTOR UNIT PRODUCING "ARTIFICIAL DAYLIGHT" FOR MATCHING COLORS IN DYE SHOPS, TEXTILE MILLS, ETC.



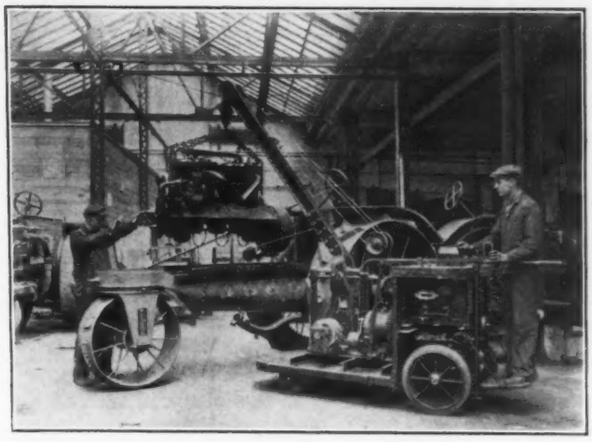

CURVE SHOWING DISTRIBUTION OF ENERGY IN SPECTRUM OF CARBON-DIOXIDE TUBE LAMP

The foot-candles available near the tube total more than 200, making this apparatus suitable for the very closest color discriminations. The degree of vacuum is automatically held within 0.001 mm. of mercury column, and the apparatus will stand wide line-voltage fluctuations without becoming disarranged in any way.

This new lamp has been found suitable for making absolutely correct color determination, and while it is applicable to a very wide field, it is particularly useful in enabling the dye shops of the great textile industry to run night shifts.

## Electrically Operated Crane Truck

In the accompanying illustration is shown a crane-type truck which is being successfully used in several automobile plants. The capacity of the crane is 1000 lb. The boom as well as the hoist is motor-operated, the

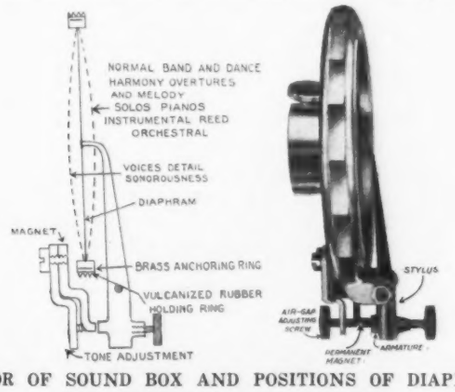


ELECTRIC CRANE-TYPE TRUCK FOR SHOP SERVICE

energy being taken from the same storage battery which furnishes energy for the propelling motor. The speed of the truck is from 5 miles to 8 miles per hour. The truck is built both with an extended platform and with a platform cut close to the base of the crane. It is being made by the Elwell-Parker Electric Company, Cleveland, Ohio.

## Phonograph Diaphragm Operating on Magnetic Principles and Adaptable to Telephone Circuits

A phonograph diaphragm for which numerous advantages are claimed by the manufacturer depends for its improved performance on magnetic principles. Among its advantages are clearness and trueness of either band or vocal reproductions without surface tones, blasts or chatter; strength of reproductions or reaching qualities, and adaptability to any kind of record (lateral or hill-and-dale cut). These qualities make it particularly suited to teaching foreign languages and instrumental music. By some modifications it may also be




EXTERIOR OF SOUND BOX AND POSITIONS OF DIAPHRAGM FOR DIFFERENT REPRODUCTIONS

adapted to telephone circuits for the transmission of music.

The device consists of a mica diaphragm having a rubber ring vulcanized to its periphery, which is clamped in the percussion chamber or sound box by flanges, thus permitting the diaphragm to vibrate freely and eliminating the smothered sound which might be produced without the piston effect.

Attached to the center of the diaphragm is a lever which keeps the diaphragm under tension and transmits the vibrations imparted to the phonograph needle. The tension in the diaphragm is produced by a small permanent magnet which attracts an armature on the end of the lever. With the pull thus produced there is no stiffness in the motion as might occur with a mechanical spring, so vibrations are reproduced without change in their pitch, amplitude or quality, it is claimed.

To eliminate overtones in accompaniments to vocal reproductions, the tension in the diaphragm is reduced by turning a screw that mechanically increases the air-gap and thereby changes the bulge in the diaphragm. Thus the volume of air which must be compressed in the sound box is reduced, producing perfect voice tones. Furthermore, the reproductions can be made with more strength and reaching qualities as less air must be set in vibration. If the diaphragm tension was not changed for band music, which represents more energy, blasts would be produced.

The Nolen Accessories Company, 2 West 140th Street, New York City, manufactures the device.

## Series Street-Lighting Fixtures for High-Efficiency Tungsten Lamps

Among the recent additions to its "Novalux" line of fixtures for series street lighting with high-candle-power gas-filled lamps made by the General Electric Company, Schenectady, N. Y., are the "Form No. 6" units, as they are called, shown herewith. The units are being made in sizes designed for use with 5.5-amp., 6.6-amp. and 7.5-amp. straight series lamps and 400-cp., 15-amp. and 1000-cp., 20-amp. series lamps. For operating the high-candle-power lamps, the fixtures are

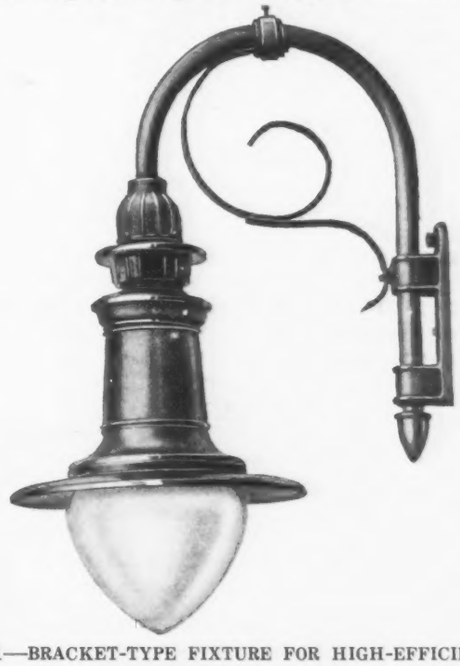


FIG. 1—BRACKET-TYPE FIXTURE FOR HIGH-EFFICIENCY INCANDESCENT LAMPS

equipped with self-contained auto-transformers so that they can be connected to standard constant-current circuits of either 6.6 amp. or 7.5 amp. The units are of two general types, one for mounting on brackets or permanent attachment to mast arms and the other for the ordinary method of suspension.

The bracket-type unit is equipped with an insulator which is designed to withstand pressures up to 25,000

volts. Either open or concealed wiring may be employed. For open wiring the unit is provided with flexible leads equipped with soldered connecters of large cross-sectional area. The wires may also be brought directly into the fixture by bringing the leads to the tying ears on the insulator and then through the insulator to the interior binding posts. For concealed wiring the leads can be brought through the bracket pipe, through the hood into the top of the insulator and to the binding posts.

Any one of the following combinations of light-distributing equipment may be employed with either the pendent or bracket types of units: No. 87 light "Carrara" outer globe; No. 87 light "Carrara" outer globe and 20-in. reflector; prismatic refractor and 20-in. reflector. The refractor is of two sections of prismatic glass with the prisms facing each other on the inside.

Mesh-protected openings under the lower flange of the casing near the globe are provided for ventilating purposes. The air circulates around the socket and passes

FIG. 2—PENDENT UNIT WITH PRISMATIC REFRACTOR

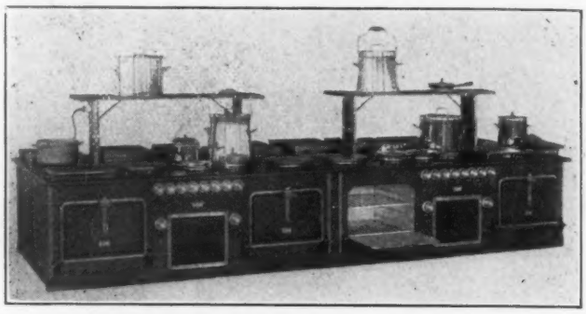
out through fine mesh-protected openings under the dome of the lamp. The globe holder is hinged to permit ready access to the lamp. The casing is of spun copper with black oxidized finish. The reflector is of steel with white fire-enameled reflecting surface.

## Single-Phase Rotary Converters

Attention is called to an article which appeared in these columns on Nov. 6 by Val. A. Fynn on "Recent Improvements in Single-Phase Rotary Converters," in which it is stated that the converter described starts as an inductively neutralized, single-phase induction motor. The word "induction" should read "conduction."

## A 69-Kw. Electric Range to Cook for 1500 Hospital Patients and Employees

Following a recent investigation of the practicability of electric cooking, the Montana State Hospital for the Insane at Warm Springs, Mont., has purchased one of the largest electric ranges in the world for immediate installation in connection with an unusually efficient system of food handling between the hospital kitchen and the dining-rooms. The range is the largest ever built by its manufacturer, the Simplex Electric Heating Company of Cambridge, Mass., and has a total connected load of 69 kw. It is built in four similar sections each 7½ ft. long and 2 ft. 9 in. wide, and is to be installed with sections back to back, occupying a floor space 5½ ft. by 15 ft., enabling the cooking staff to



LARGE-SIZED RANGE FOR MONTANA STATE HOSPITAL

work on both sides. There are two ovens in each of the four sections, each oven having sufficient capacity to roast twenty-four chickens or 80 lb. of beef at once.

The top equipment comprises the following units, each controlled by a separate switch with ruby pilot lamp and three adjustable heats: Seven 18-in. by 24-in. hotel griddles, with rims; two 18-in. by 24-in. flat griddles or hot-plates; one 12-in. by 18-in. corrugated surface broiler; one 12-in. frying kettle for deep fat; one six-slice hotel-type bread toaster; five 15-in., two 10-in. and five 8-in. round hot-plates.

The heating units are of the enamel type, and the controlling switches are conveniently mounted on the front of the range at a height providing for ease in handling. No smoke flue is required, and the work of installing the range will consist merely in placing the range in position after assembling the sections and connecting the leads from beneath the kitchen floor to binding posts provided on the inside of the body of the range and accessible through removable panels between the ovens.

The estimated maximum demand is 46 kw., and, on the basis of 0.25 kw.-hr. per person per day, the energy consumption in cooking for 1000 persons is estimated to amount to 250 kw.-hr. per day, or 7500 kw.-hr. per month, making the cost of electricity at a 2-cent rate $150 per month. This is offset against the cost of coal, cost of handling coal and ashes, and additional attendance required for handling a coal outfit. There will also be decided savings in food as the result of improved cooking compared with cooking on coal or gas ranges, avoiding waste due to over-cooking and under-cooking, excessive shrinkage, etc. The latter costs in many cases amount to even more than the cost of fuel. The space required by the electric range is less than that for a coal or gas range of equal rating.

## Combination Current Tap and Lamp Receptacle

On account of the rough usage given electrical fittings in industrial plants, Harvey Hubbell, Inc., Bridgeport, Conn., has developed a combination current tap and lamp receptacle made of a tough heat-proof composition. While the device is designed primarily for industrial establishments, it is also adapted for household use. It is fitted with standard contacts and is interchangeable with a number of types of key-slot wall and flush receptacles made by the above-named manufacturer.

## Lever Switches for Low-Voltage Circuits

In England and a number of other countries use is generally made of the so-called tumbler or lever switch instead of the turn switch for incandescent-lamp and other low-voltage circuits. A number of types of lever switches are being placed on the market by A. P. Lundberg & Sons, 477 Liverpool Road, London N., England, several of recent development being illustrated herewith.

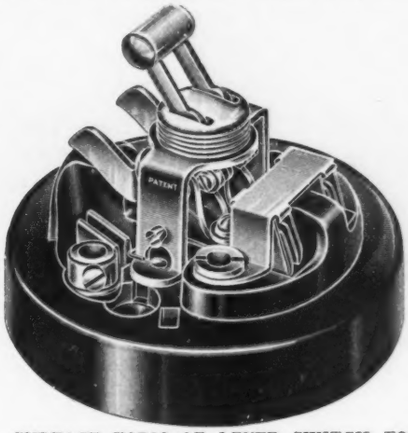



FIG. 1—SURFACE FORM OF LEVER SWITCH FOR LOW-VOLTAGE CIRCUITS

In Fig. 1 is shown a single-way switch which breaks the circuit at four points. The "Quadbreak" switch, as it is called, is built in sizes with ratings of 10 amp. and 5 amp. at a pressure of 250 volts. A switch of similar

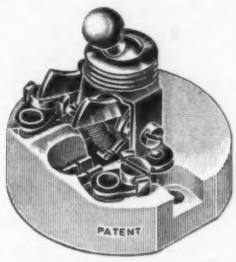



FIG. 2—FLUSH-TYPE LEVER SWITCH

design of the flush type is also being made with a rating of 5 amp. at 250 volts. This switch is illustrated in Fig. 2. The terminals of the flush-type switch shown are designated as of the "Admiralty" pattern. It is not necessary to bring the wires back through the base of the flush-type switches. The advantages of the surface

FIG. 3—SURFACE-TYPE LEVER SWITCH CONSISTING OF TWO SINGLE-WAY SWITCHES ON ONE BASE

form of switch shown in Fig. 1 are, according to the manufacturers, as follows: Screws are accessible in the most confined situations and good connection and excellent contact are provided.

A "twinob" switch, as it is called, of the surface type, with cover in position, is illustrated in Fig. 3.

## Large-Sized Electric-Cooking Apparatus

A number of types of electric ranges for hotels and restaurants are being made by the Carron Company, Carron, Falkirk, Scotland, some of which are shown herewith. One interesting installation of the company's apparatus was recently made in the remodeled kitchen

FIG. 1—ELECTRIC RANGE WITH THREE OVENS

at the Royal Pavilion, Brighton. It consists of the two electric ranges illustrated in Figs. 1 and 2, which are shown on the testing floors before shipment.

The larger range, shown in Fig. 1, is equipped with two roasting and baking ovens, each of which is 20 in. wide by 24 in. high by 18 in. deep. Between these two ovens is another oven 40 in. wide by 24 in. high by 18 in. deep, which is provided with two doors. The walls of the oven are double-cased and are packed throughout with heat-insulating material. The inside of the oven is lined with porcelain-enameled steel sheets. Each oven is fitted with hinged shelf racks, grids, tinned-iron drip tray and meat hooks, all of which can be readily removed for cleaning. The heating elements, which are fitted at the top and the bottom, are mounted in strong cast-iron frames and can be removed by simply sliding them out. Each element is wired with two parallel circuits to permit of series-parallel control; thus each 20-in. oven has six ranges of energy consumption or control and the 40-in. twelve ranges of control. The hot closet above the oven is provided with four steel sliding doors. It is divided in the center, and each section is separately heated and wired for series-parallel control. The switchboard is of polished peak and is equipped with rotary indicating series-parallel

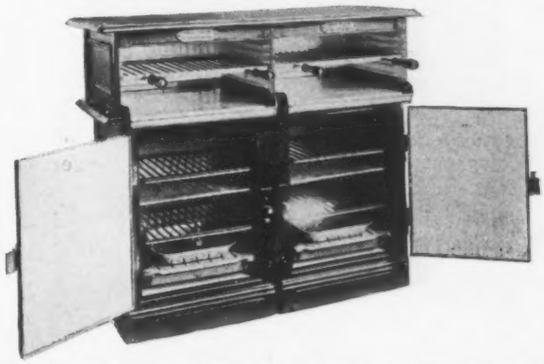


FIG. 2—ELECTRIC RANGE WITH TWO OVENS AND GRILL

switches, "Zed" fuses and pilot lamps for every circuit. The two outer ovens are rated at 3500 watts, the center oven at 7000 watts, and each hot closet at 1000 watts.

The smaller range, illustrated in Fig. 2, is equipped with two ovens 20 in. wide by 24 in. high by 18 in. deep, the same size as the outside ovens of the large

range. Above the ovens is mounted a double grill which is white-porcelain-enameled inside, each compartment being 2 ft. wide by 12 in. high by 18 in. deep. Each oven is rated at 3500 watts and each compartment of the grill at 6000 watts.

A combined cooking range is shown in Fig. 3. It consists of two 20-in. ovens and one 16-in. hot closet

FIG. 3—COMBINED COOKING RANGE WITH OVENS, HOT PLATES, HOT CLOSETS AND GRILL

surmounted by a continuous cast-iron hob carrying the boiling plate, a simmering plate and a bain-marie. The ovens have double doors, the inner ones being provided with plate-glass panels so that the process of cooking can be observed without opening them, thus preventing loss of heat. The outer doors are lagged and act as a shield to the glass doors. The grill, which is 18 in. wide, is over the hot closet. The bain-marie consists of a copper body tinned inside and recessed at the back of the grill with holes in the top to take the vessels.

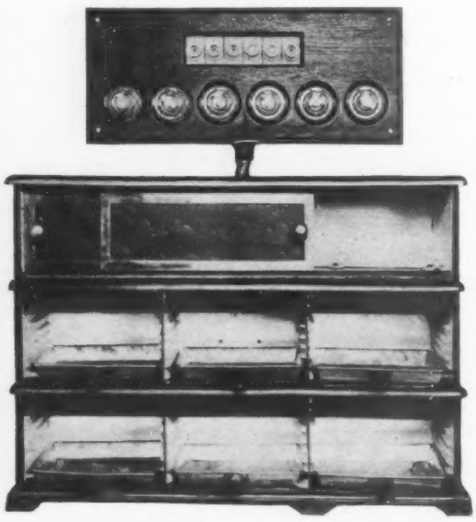


FIG. 4—GRILLING APPARATUS FOR HOTEL IN GLASGOW

All the heating elements are interchangeable and with the exception of that of the grill are arranged for three-heat regulation. The ovens are 20 in. wide by 24 in. high by 18 in. deep. The boiling plates are 6 in., 8 in. and 10 in. in diameter respectively. The hot closet is 16 in. wide by 22 in. high by 15 in. deep, and the simmering plate is 18 in. by 14 in. The range and switchboards illustrated are designed for a 460-volt three-wire system.

The grilling apparatus shown in Fig. 4 was especially designed by the Carron Company for use in a Glasgow hotel. Each of the six compartments is rated at 1500 watts. According to the manufacturer the apparatus is worked at its highest pressure on Saturdays, when from noon until 10.30 p.m. it turns out on an average 700 grilled rarebits.

## Mercury-Type Ampere-Hour Meter

It is said that some 90 per cent of the instruments utilized in England in measuring direct current are ampere-hour meters, and of these a large number are of the mercury type, one of which, developed by Ferranti, Ltd., Hollinwood, Lancashire, England, is shown herewith. The rotor of the instrument illustrated consists of a copper disk which is immersed in mercury and rotates in the gaps of two permanent magnets. As shown in the diagram in Fig. 2, the energy passes from the positive terminal to the circumference of the mercury bath, through the disk and the mercury to the

MERCURY-TYPE AMPERE-HOUR METER

center, and thence through a compensating coil to the negative terminal. The meter is simple in construction and is strong mechanically. The dials are either of the clock or cyclometer pattern. To prevent the escape of the mercury during transit a clamping device is employed which effectively seats the mercury bath, it is asserted, and also supports the disk independently of the bearings, thus protecting the jewels from damage. Advantages claimed for the meter are as follows: The driving torque is high, because with meters with ratings up to 20 amp. all of the energy passes through the meter. The rotor is so adjusted that not more than 5 grams of its weight is in the mercury; the ratio of torque to weight of rotor is therefore high. The starting current is very small, being not more than 0.05 amp. in the small sizes. The limits of error for the 1.5-amp. meter are 2.5 per cent from full load to quarter load and 5 per cent from quarter load to one-tenth load; for the 3-amp., 5-amp. and 10-amp. instruments, 2.5 per cent from full load to one-tenth load and 5 per cent from one-tenth load to half load, and for the 20-amp. and larger meters, 2.5 per cent for one-tenth to half load. The meters are designed to be overloaded 25 per cent continuously, 50 per cent for one hour, and 100 per cent momentarily. Adjustment of speed up to 5 per cent can be made by adjusting screws provided. The speed of the rotor is low and varies with the size of the meter but never exceeds 60 r.p.m. at normal full load; the low speed, combined with the low weight, therefore, it is declared, reduces the wear of the jewels to a minimum.

# News of the Industry

*A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields*

## PROSPERITY WEEK ONLY NINE DAYS OFF

### Arrangements for Celebration Taking Definite Form in Hundreds of Towns and Cities — Diversified and Novel Ideas of Local Committees

Arrangements for Electrical Prosperity Week—Nov. 29 to Dec. 4—have now reached a point where the actual magnitude of the celebration is evident on every hand. The movement is assuming such proportions and developing with such rapidity in all sections of the country that the real benefit to be derived by the industry may be confidently expected to be immense.

Joining with the electrical press, the popular magazines are taking up the slogan, "Do it electrically," and millions of people will be reached through the medium of their advertising and reading columns. The special electrical number of *Collier's Weekly*, to be got out Nov. 23, was mentioned in last week's issue. In addition, the *Saturday Evening Post*, the *National Food Magazine* and the *Scientific American* are also to publish special electrical numbers.

#### Uniform Display for Center of Windows in Kansas City

The celebration of Electrical Prosperity Week in Kansas City (Mo.) is being planned with the active co-operation of jobbers, contractors and central stations, with carefully worked-out programs for bringing the subject of electricity to the attention of the public. The Kansas City Electric Light Company will use streamers, banners and placards, chiefly on the street cars of the city, and it is expected that the interurban railways will also join in this means of display. C. F. Farley, commercial manager of the light company, is taking an energetic part in the arrangements. A. P. Denton, president of the local contractors' association, is chairman of the sub-committee on details, and this committee has already got well under way the chief feature of the event, which will be the decoration of windows. All contractors and dealers will have displays uniform in respect to the central or dominating element, which probably will be either a poster or some other device mentioning or emphasizing the occasion. It is expected that the display of this feature, whatever else is in the windows, will attract attention and cause investigation. The co-operation of the merchants' association is being obtained, so that windows of stores in all lines will also use the central design of Electrical Prosperity Week.

Through the advertising club it is expected that a majority of the display advertisements of the week will touch on electricity in one way or another, and that the newspapers will further exploit the subject by news articles and pictures suitable to the occasion.

#### Lincoln Extends Period of Celebration

The Lincoln (Neb.) Electric Light & Power Company, with its usual aggressiveness, is making comprehensive plans for Electrical Prosperity Week. Not only will the one week designated as Electrical Prosperity Week be observed, but in addition one week before and two weeks after have been advertised as a special sale period. During the four weeks the display room of the company will be specially decorated, in a different manner for each week, and there will be music in the store in the afternoons and evenings. Grills, percolators, chafing dishes and heating pads are all to have a week of special display and are to be sold at a small discount. Special newspaper advertising will bring the displays to the notice of the public at large, and the windows are to be decorated with "trims" from the Society for Electrical Development. An expert window trimmer has been engaged for the occasion. The five regular salesmen will continue their house-to-house sales work during the period, and the company's policy of straight sales and no trial sales will be maintained.

#### Indianapolis to Have Elaborate Exposition

The Indianapolis (Ind.) Society for Electrical Development has begun preparations for staging an exhibition in celebration of Prosperity Week, which the officers say will be of the most lavish character. Local manufacturers, wholesalers and retailers of electric appliances and machinery, the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company will join to make the celebration one that will attract the attention of the entire State.

The exposition will be held in the rooms formerly occupied by a big furniture company at Pennsylvania and Vermont Streets. The building is to be decorated inside and out, and during the exposition its whole neighborhood will be ablaze with light and color. It is planned to make the Indianapolis exposition a stimulus to the "shop-early" idea, which has been fostered locally for the past half-dozen years at each Yuletide. The celebration is under the general direction of a committee which includes G. M. Sanborn as chairman, T. B. Hatfield, R. A. McGregor, L. U. Murray, A. M. King and C. C. Perry. The exposition is to be opened by a concert by the Indianapolis *News* Newsboys' Band.

Illumination of the principal buildings of the city, exhibits and demonstration of electrical appliances, etc., have been provided for Electrical Prosperity Week by the Jovians of Nashville, Tenn. The Nashville Railway & Light Company will co-operate by putting up electric signs and by distributing electrical guide booklets. The Jovian committee which has charge of the celebration is composed of J. Pink Lawrence, James E. Carnes, J. H. Ansley, James A. Shingleton, A. G. Maddux and L. R. Ritter.

#### Expert Engaged to Conduct Activities

Louisville Jovians have completed their preliminary preparations for Electrical Prosperity Week and have engaged Henry B. Marks, an experienced celebration engineer, who will have charge of details from now on. Mr. Marks has established headquarters at 422 West Green Street and has a force of clerks and others to assist him in working out the undertaking. Altogether sixty concerns and individuals will be represented in the exhibit of electrical appliances, etc., which will be staged during the week at the armory, and the parade will be larger than was at first expected by the promters of the exhibit.

Popular interest in Electrical Prosperity Week has been stimulated at Worcester, Mass., by the announcement that the Worcester Electric Light Company has offered a gold prize for the best display and window decorative exhibition of electrical appliances during the week. The company will conduct a miniature electrical

exhibition during the week at its offices on Main Street, and a large amount of extra display lighting is being planned among merchants. Many special sales and displays are being planned by local contractors and dealers. The current number of the *Worcester Magazine*, issued by the local Chamber of Commerce, is running an article more than a page in length relative to the significance of the week to the electrical industry and the public.

In Buffalo, N. Y., it is the intention to give publicity in the various displays to the fact that the rates for motor service, heating and lighting are cheaper there than elsewhere owing to the proximity to Niagara Falls, the source of the power. Lafayette Square is to be specially illuminated, probably by placing a cylinder of colored lights around the monument.

#### Peoria Electric Club to Hold Show

The Peoria (Ill.) Electric Club will hold an "electrical prosperity show" during the week. City Electrician Wolgamott is in charge of the arrangements. Motion pictures of electrical progress and discoveries will form one of the features of the show. "Jovian Night" and "Amateur Night" will be feature events of the week. A "What's Watt" contest is another feature being arranged.

It is the boast of the managers of the Electrical Prosperity Week electric show at Cincinnati, Ohio, that everything electrical, from a money-washing machine to an automobile lamp, will be on display. Arrangements have been made with local banks for securing $10,000 in soiled bills daily, and this amount will be cleaned impressively by the motor-driven machine behind a row of burly policemen. At the exhibit of the Union Gas & Electric Company a house-wiring demonstration, accomplished in the record-breaking time of twenty minutes, will be a feature. An exhibit of the American Telephone & Telegraph Company will also be displayed at the Cincinnati show, making it possible for 800 persons at one time to watch motion pictures of the ocean waves on the Pacific Coast and hear the roar of the waves by telephone over the transcontinental line.

#### Plans in Other Ohio Cities

At Dayton co-operation of the ministers in the various churches has been sought, with the result that prosperity sermons will be preached from practically all Dayton pulpits on Sunday, Dec. 3. Parades and Jovian rejuvenations and activities, in co-operation with other organizations, have been planned for every day of the week.

The Springfield electrical interests, in order to add strength and interest to the local Prosperity Week campaign, have joined forces with a commercial travelers' organization which is holding a fair in Springfield during that week.

At Toledo a combination has been effected with the Ohio and Michigan food show. More than 250 display booths have been sold, and an exceptionally large attendance is expected.

---

### De Forest Confers with the British Admiralty on Protection Against Air Raids

Dr. Lee de Forest, the inventor of the audion for use in radio work, has just returned from England, where he was in conference with the British Admiralty in connection with his system for protection against attacks from aircraft. The application of the system is based on the advantages of electricity and acoustics, but any further information regarding the details, Dr. de Forest stated, cannot now be made public. According to the present plans, Dr. de Forest said the Admiralty will immediately test the system on a small scale to determine its adaptability to actual warfare conditions.

### Embargo Placed on Platinum by European Governments Causes Scarcity of Metal Here

Early in August, 1914, England, France and Russia refused to sell platinum to foreign nations, and since that time the available supply in the United States has become very small. The largest platinum mines in the world are in Russia, which before the war began furnished practically all of the platinum used in the world. England and France, while they mine no platinum, have large refineries, and previous to the outbreak of hostilities were large exporters of the metal.

The embargo has caused such a scarcity of the metal in the United States that it is practically impossible to supply the demand. The only two sources of supply at present are Colombia, South America, which is shipping a small amount of the crude material to be refined in this country, and scrap metal. The supply from South America is exceedingly small and in no way begins to meet the demand. The scrap supply, besides being small, is not certain and must shortly run out.

Prices are now double what they were just previous to the war, when platinum could be purchased from $40 to $45 per ounce. The initial advance in price in the early stages of the war was not maintained, the price falling back almost to normal, but recently the scarcity of supply and the increased demand have caused a large jump, resulting in the present record prices of over $80 per ounce.

Prominent refiners of platinum in the United States, recognizing the seriousness of the situation, have written to the government at Washington asking that the United States make efforts through diplomatic channels to have the embargo removed.

Besides its use in jewelry, platinum finds a large use in the industrial field for purposes where it is absolutely essential. This is particularly true of certain electrical apparatus and in the manufacture of explosives.

It is its use in this latter connection that caused England, France and Russia to prevent the shipment of the metal to this country. It was stated, however, by a prominent refining company in this country that American manufacturers of explosives for the Allies were still receiving their necessary supply of platinum from Europe.

---

### Massachusetts Electricians' Examination

The Massachusetts Electricians' Licensing Board held an examination for masters' and journeymen's certificates at Boston on Nov. 17. About 150 applications were received.

Since the organization of the board 600 persons have taken the examinations. Practically all have passed the second, if not the first, test. The board has recently ruled that a part-time electrical worker, like the engineer of an isolated plant, who can show that he devotes at least 50 per cent of his time to electrical construction or maintenance may apply for a journeyman's certificate. The Electrical Contractors' Association of Massachusetts has recently placed an experienced electrical worker on the road within the State to make a thorough survey of the certificate-holding situation, with the object of bringing court proceedings against violators of the license law. The board is planning to publish a list of all licensees about Jan. 1, arranged by municipalities and covering both masters and journeymen. It is expected that the recommendations to the next Legislature will embody the proposed abolition of the present unsatisfactory exemption from taking examinations upon presentation of a statement to the effect that the applicant has worked as a master or journeyman for five years before his application.

# NOTES
ON ELECTRICAL TOPICS

**Phenomenal Growth of Detroit Edison Company.**—The Detroit Edison Company, in a recent advertisement, states: "Detroit's population in ten years increased 90 per cent, the factory buildings 85 per cent, the factory employees 133 per cent, and the electrical developments 2000 per cent."

**Projected Water-Power Developments.**—Water-power developments in the United States to the value of $100,000,000 are now being projected, the completion of which will be contingent on the passage by Congress of satisfactory water-power legislation, according to T. W. Martin of the Alabama Power Company.

**Increase in Use of Large Outdoor Substations.**—More than 20 per cent of the outdoor transformers in use in 1914 were rated at over 200 kw., while five years ago only 2 per cent were rated at more than 200 kw. It has been estimated that the entire rating of outdoor substations in 1914 was 300,000 kw., as compared with 500 kw. in 1910.

**Post-Card System of Billing Inaugurated in Salt Lake City.**—The Salt Lake City division of the Utah Power & Light Company recently inaugurated the post-card system of billing all single-meter customers. Customers having more than one account, these constituting about 10 per cent of the entire customer list, will receive their bills in envelopes as before.

**Pennsylvania Railroad Puts Telegraph Wires Underground in Philadelphia District.**—The Pennsylvania Railroad Company has placed its telegraph and telephone lines throughout the Philadelphia electrified zone underground, in accordance with a decision reached following the heavy sleet storm of March, 1914, which caused so much damage to overhead lines in the Eastern States.

**New-Business Department Springs Surprise During Fireworks Display.**—In the midst of the fireworks display at the recent Durham (N. C.) county fair the new-business department of the Durham Traction Company suddenly turned on the switch of a large electric sign reading "Do It Electrically." Its effect on the spectators was gratifying, for instantaneously hearty applause broke out.

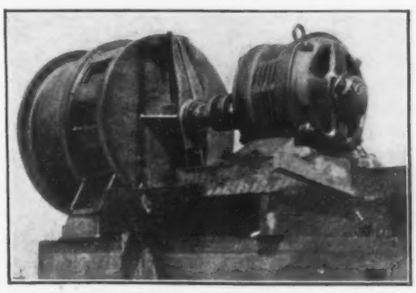
**Data on Transcontinental Telephone Line.**—Carried on 130,000 poles, the new transcontinental telephone line crosses thirteen states. The wire weighs 5,920,000 lb. and is part of a system which has 9,000,000 telephones, connected by 21,000,000 miles of wire. There has been expended on the transcontinental line $620,000,000, or twice the cost of the Panama Canal during the nine years of its building by the United States.

**Electric Fan and Light to Trap Insects.**—A scheme recently devised to catch insects makes use of an electric lamp placed between an electric fan and a cone-shaped bag of fine net. The fan faces the opening of the bag, which is of the same diameter as the fan, so that insects attracted by the light are caught by the air currents from the fan and driven into the bag. On account of the strong breeze from the fan the insects cannot escape from their trap. A patent on the scheme has been issued to K. G. Gyllstrom.

**Parallel vs. Standard Arrangement of Lamps.**—In the article by H. E. Butler appearing under the above title in our issue of Nov. 6 the sixth column of the table of illumination values for parallel spacings, on page 1028, should have read 1.50, 1.45, 1.43, 1.41, 1.41 and 1.40.

**Dedication of New Home of Massachusetts Institute of Technology.**—President Richard C. Maclaurin of the Massachusetts Institute of Technology, Boston, has announced that the new buildings of the Institute in Cambridge, fronting the Charles River Basin, will be dedicated on June 14, 1916, during Commencement Week. The structures are already well advanced toward completion. Practically all the stonework and most of the carving is completed, and the steam-heating system is ready in ten of the buildings forming the group. The boiler house will be completed later in the month, and work is rapidly progressing upon the ventilation systems, drainage equipment, fire-protection service, and pipe and cable subway. Electric polishers are now finishing the floors.

**A Motor-Driven Siren That Can Be Heard Ten Miles.**—What is said to be the largest siren in the world, pictured herewith, is installed on the top of the Palace of Machinery at the Panama-Pacific Exposition. The blast of the device can be heard, it is declared, for a distance of ten miles. The siren is utilized for announcing daily events, such as aeroplane flights, military drills, marine pageants, and similar functions, and is operated by a 5-hp. Westinghouse induction motor. When President Wilson officially opened the Exposition at San Francisco last February by pressing a button at the White House he completed an electric circuit over a telegraph line to the wireless station operated by the United States Navy Department at Tuckerton, N. J. Here relay keys were operated and the wireless waves sent out by the Tuckerton station, received at San Francisco, served to set into operation many of the mechanical exhibits of the Exposition, including this siren.



MOTOR-DRIVEN SIREN ON PALACE OF MACHINERY, SAN FRANCISCO, WHICH CAN BE HEARD 10 MILES

**One-Quarter of Industrial Accidents Due to Poor Light.**—An investigation recently made of 91,000 industrial accidents revealed that nearly 23,000, or 25 per cent, of them were due directly or indirectly to poor light.

**Average Cost of Wiring Houses Already Built.**—During the first ten months of the present year the average cost of wiring houses already built in Louisville, Ky., including fixtures and lamps, was $27.80. This figure was made possible, the Louisville Gas & Electric Company states, by close co-operation between the company and the contractors.

**Quebec Streams Commission Proposes to Dam St. Francis River.**—In order to increase the amount of storage and tide over low-water conditions, the Quebec Streams Commission proposes to build a dam on the St. Francis River at an estimated cost of about $400,000. The low-water level of Lake St. Francis will in this way be raised some 27 ft., and it is thought that an additional 6000 hp.-years will be provided.

**English Committee to Study Problems of National Fuel Economy.**—A committee of representative chemists, engineers and technical men from all of the principal industrial centers in England has been invited by the British Association for the Advancement of Science to make a study of and report on the question of fuel economy from a national point of view. The more important considerations will be the utilization of coal and smoke prevention.

**New Course in Elementary Electricity for Boston Edison Employees.**—The educational committee of the Edison Electric Illuminating Company of Boston has announced a new course, entitled "The Essentials of Electric Light and Power." The course will begin some time in January and will continue for twenty-four weeks. As far as possible, the course will be taught by object lessons, without textbooks, by members of the company's staff.

**Fall River Company in New Home.**—On the first of November the Fall River (Mass.) Electric Light Company moved into its new home at 85 North Main Street. The building is three stories high, finished within in Flemish oak. Half of the first floor will be devoted to exhibiting appliances, the remainder being used by the accounting department. The executives have offices on the second floor, and the purchasing department is on the third floor.

**Electricity in English Coal Mines.**—The total rating of electrical machinery used in coal mining in England in 1914 was 713,782 hp., of which 419,690 hp. was used under ground and 294,092 hp. above ground, according to the recent report of the inspectors of mines. Electricity found many uses in coal mining, the largest being for pumping. For this operation 193,953.5 hp. was employed. While less than 10 per cent of the coal mined was cut by machinery, almost 60 per cent of the machine-cut coal was cut with electrical machinery. A little over 10 per cent of the miners' lamps in use were electric lamps.

# Associations and Societies

**Associated Manufacturers of Electrical Supplies.** — A meeting of the board of governors of the Associated Manufacturers of Electrical Supplies will be held at the Hotel Biltmore, New York City, on Dec. 2, 1915.

**Manufacturers of Inclosed Fuses.** — A meeting has been called for Dec. 2, at 3 p. m., at the Biltmore Hotel, New York City, by the manufacturers of inclosed fuses to consider the formation of a section, acting under the approval of the board of governors of the Associated Manufacturers of Electrical Supplies.

**Purdue Branch, A. I. E. E.**—An illustrated lecture was given on Oct. 26 before the Purdue University branch of the American Institute of Electrical Engineers at Lafayette, Ind., by A. S. Young of the Leeds & Northrup Company, Philadelphia, Pa., on the subject of "The Manufacture and Test of Electrical Instruments."

**Pittsfield Section, A. I. E. E.**—The Pittsfield Section of the American Institute of Electrical Engineers held its second fall meeting at the Hotel Wendell on Oct. 28. P. Torchio, chief electrical engineer of the New York Edison Company, spoke on "Electricity Supply in Large Cities." The address was illustrated with lantern slides and charts.

**New Officers of New England Section, E. V. A.**—At the recent annual meeting of the New England Section of the Electric Vehicle Association of America the following officers were elected to serve during the coming year: Chairman, J. T. Day; vice-chairman, Albert Weatherby; treasurer, L. L. Edgar; secretary, C. H. Miles; executive committee, E. S. Mansfield, W. A. Blachford, R. B. Daggett, George H. Hudson, Fred M. Kimball, E. J. Stone, C. A. White and F. H. Smith.

**New York Electrical Society Visits Equitable Building.**—The members of the New York Electrical Society on Saturday afternoon, Nov. 13, visited the new Equitable office building, where a complimentary luncheon was served to the members in the Café Savarin. When the luncheon was over, C. T. Coley, operating manager of the building, gave a talk on some of its interesting features. Small parties were then formed, which were conducted through the building, visiting all the places of interest.

**Syracuse Technology Club Hears Address on Salmon River Plant.**—An illustrated lecture telling of the potentialities of the Salmon River power plant was given on Oct. 25 by L. C. Nicholson, electrical engineer of the Niagara, Lockport & Ontario Power Company, before the Technology Club of Syracuse, N. Y., in the assembly hall in the Vinney Building. On Nov. 8 Prof. W. S. Franklin addressed the club on "Some Mechanical Analogies in Electricity and Magnetism." Dr. John E. Sweet will be heard on Nov. 22 on "Great Men I Have Seen, and Good Men I Have Known."

**Pacific Service Section, N. E. L. A.**—The fall meeting of the Pacific Service Section of the National Electric Light Association was held at the auditorium in Oakland, Cal., on Oct. 26. Local stockholders, customers of the company and dealers in electrical supplies were invited to attend. The program for the evening consisted of instrumental and vocal numbers by employees of the company, motion pictures of electric generation and its distribution on the farm, and an illustrated lecture on Japan by John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company.

**Cleveland Engineering Society.**—At the regular meeting of the Cleveland (Ohio) Engineering Society on Nov. 9, in the Chamber of Commerce Building, E. H. Whitlock and A. J. Himes, past-presidents of the society, presented a paper on "The Future of the Engineering Profession," in which the interrelations of engineering and technical societies were discussed. A special meeting of the society has been called for Nov. 23, when William H. Alexander, local forecaster United States Weather Bureau, will deliver an address on "What the United States Weather Bureau in California Is Doing for the Benefit of the Engineer."

**Empire State Gas & Electric Association.**—The program of meetings of the Empire State Gas & Electric Association for the remainder of the year 1915-1916 has been announced as follows: Dec. 10, gas production committee in Amsterdam; Jan. 14, electric production committee in Binghamton; Feb. 11, gas distribution committee in Yonkers; March 10, electric distribution committee in Syracuse; April 7, electric meter committee in Ithaca; May 5, general meeting in Buffalo; June 9, gas production committee in Coney Island; July 14, electric production committee in Watertown; Aug. 11, gas distribution committee in Oswego; Sept. 8, electric distribution committee in Glens Falls.

**Utah Power & Light Company Section, N. E. L. A.**—The winter activities of the Utah Power & Light Company section of the N. E. L. A. were inaugurated Oct. 28, when officers for the ensuing year were elected as follows: Chairman, C. E. Groesbeck, vice-president and general manager; vice-chairman, D. C. Green, manager Salt Lake division, and treasurer, P. M. Parry, manager Ogden division. S. R. Inch, operating manager of the company, in a brief talk quoted statistics showing the rapid growth of the electrical industry. The company N. E. L. A. section, he said, brings first-hand information of latest developments to every employee. Markham Cheever, chief engineer, also spoke of the advantages of N. E. L. A. membership.

**Commonwealth Edison Section, N. E. L. A., Has 959 Members.**—At the eighth annual meeting of the Commonwealth Edison Company Section of the National Electric Light Association, held Nov. 10 in Customers' Hall of the new Edison Building, about 1000 of the company's employees were present. George B. Foster, retiring president of the section, presented his annual report, and addresses were made by Samuel Insull and E. W. Lloyd. In his address Mr. Foster said that the section now has 959 members in good standing. As part of the evening's program, presentation was made of the Insull Medal and other prizes given for the best papers written during the year and for the best suggestions regarding changes in the company's methods and practices. The prize winners were E. E. Campbell (Insull Medal), W. D. Knowlton, A. D. Bailey, G. M. Swain, I. S. Rankin, Peter Reuter, A. G. F. Schuster and P. F. Withers. Section officers elected for the ensuing year are: President, Mr. A. D. Bailey; vice-president, Harold Wright; treasurer, William A. Fox; secretary, H. E. Paaren.

**Kansas City Jovian Club Officers.**—The first meeting of the Jovian Electric Club of Kansas City under the new administration was held at Morledge's restaurant on Nov. 16, when the following new officers formally took charge: President, Herman F. Lang, Missouri & Kansas Telephone Company; vice-presidents, J. D. Todd, Western Electric Company; A. P. Denton, Denton Engineering & Construction Company; A. N. Richardson, Kansas City Electric Light Company; W. S. Blue, Westinghouse Electric & Manufacturing Company; secretary and treasurer, C. W. McDaniels, Missouri & Kansas Telephone Company; executive board, F. M. Bernardin, P. Loyd Lewis, R. D. Obermeyer and F. B. Uhrig. Hold-over members of the board are W. M. Hand, E. E. Stigall, W. J. Squire, H. W. Ritterhoff and A. P. Denton. The following appointments of committee chairmen were announced: Employment, E. E. Stigall; civic affairs, F. M. Bernardin; publicity, W. S. Blue; corporations and commercial affairs, F. B. Uhrig; legislative, W. J. Squire; membership, R. D. Obermeyer; entertainment, J. D. Todd; luncheon, Herman Ritterhoff; Jovian affairs, P. Loyd Lewis; reception and entertainment, W. H. Hand.

**Philadelphia Electric Section, N. E. L. A.**—At the November meeting of the Philadelphia Section of the National Electric Light Association Douglass Burnett, commercial manager of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., will speak on the subject "Self-Advancement." At the November meeting of the meter branch of the section Henry Duus spoke on "Sangamo Meters" and Paul F. Quinlan, Jr., on "Experiences with Westinghouse Meters." A paper on the "Steam-Flow Meter" was presented at the November session of the engineering department branch by John Bernard. The commercial branch opened its fall and winter season on Oct. 25 with a paper by Charles J. Russell on "Systematic Sales Effort." The first of the fall meetings of the entire section was held on Oct. 18 with an attendance of over 500 members. The president of the company, J. B. McCall, talked on "Preparedness on the Part of the Employee." At this meeting the prizes offered by Mr. McCall for the three best papers on "Economies in Operation or Management" were awarded.

N. E. Funk received first prize for his paper on "Boiler-Room Efficiency," F. T. Adams received second prize for his paper on "A Description of Underground Construction of Conduit and Cables for Electrical Purposes," and H. Goodwin, Jr., third prize for the paper "Single, Two, Three and Four Phase Distribution."

**Council Meeting, I. E. S.**—At a meeting of the council of the Illuminating Engineering Society held on Nov. 11 it was announced that a special edition of the "Code on Lighting of Mills and Factories" would be published within a week. This edition is to be distributed to factory, mill, legislative, lighting and other authorities at a nominal price. Hereafter the badge of associate members is to have a maroon field, while that of members will be blue. A new membership certificate is to be designed and issued in the near future. Further arrangements were made for the semi-annual convention, which is to be held early next February to mark the tenth anniversary of the organization of the society. Plans for the proposed course of lectures, similar to that given at Johns Hopkins University in 1910, under the joint auspices of the university and the society, were discussed, but the place and definite dates were not set. It has been decided, however, that the course will be given early next fall, probably immediately following the annual convention, which is usually held the latter part of September. C. A. Littlefield was appointed general secretary to succeed Alten S. Miller, resigned.

## Public Service Commission News

### California Commission

The Railroad Commission of California has issued an order modifying its order of Aug. 12, which established eighteen rules to be followed by water, gas, electric and telephone utilities in the matter of service charges, service conditions and extensions, and which was announced in the ELECTRICAL WORLD of Aug. 28. An important subject of the original decision was the direction to the utilities to return guarantee deposits to consumers. The new order provides that utilities may apply existing deposits against current bills until the deposits are absorbed. The original order was effective on Oct. 11. The new one will take effect Dec. 1, 1915. The principal changes, besides the permission to the utilities to hold the existing deposits against current bills, are: Where average monthly bills are in excess of $2, such consumers may be asked to deposit twice such average accounts. The companies urged that $2.50, the maximum domestic or residence deposit, was too small in certain cases. The rule which forbids a utility to discontinue service for non-payment of bills for metered or measured service already delivered is changed so that in cases where the bill is disputed the consumer shall deposit with the commission the amount claimed by the utility, and the commission will investigate the facts and make finding. If the consumer fails to make such a deposit within fifteen days after demand by the utility the latter may discontinue service. The original rule was intended to cover the case in which a customer contests the amount of the bill and the utility, by threat of shutting off service, compels the consumer to pay a bill he believes unjust. To hold that a utility can thus be the judge in its own case, and by reason of the need of the customer for its service compel him to pay an excessive bill, is manifestly unfair, the commission holds. "We believe," the commission says further, "that the rule as now framed goes further than is necessary in that it prevents utilities from shutting off their service even in cases in which there is no dispute concerning the amount of the bill and in which the consumer simply refuses to pay an admittedly correct bill." In allowing the utilities to absorb the existing deposits against current bills, the commission says: "Some utilities have taken the position that it would be a hardship for them to be compelled to return at once in cash the deposits which they are directed to repay. To take care of these cases, we are willing to modify this paragraph." The revised order as to deposits reads as follows: "(a) Within thirty days after the effective date of this supplemental order each water, gas, electric and telephone utility shall return to the depositor all deposits heretofore made to guarantee payment for flat-rate service, and deposits made to guarantee payment for metered or measured service by customers who have paid all their bills promptly during the twelve months prior to the effective date of this supplemental order, and (b) within thirty days after demand each water, gas, electric and telephone utility shall return all deposits made to guarantee payment for metered or measured service to customers who have paid all their bills promptly during the period of service in cases in which the service has lasted less than twelve months, provided that such customers shall show ownership of the premises or shall offer guarantors satisfactory to the utility; except that if the utility so desires it may apply the existing deposit against current bills until the deposit is absorbed."

### New Jersey Commission

No distinction will be countenanced by the New Jersey Board of Public Utility Commissioners between the valuation of a property as a basis for taxation purposes and for the issuance of securities, the commission stated, in connection with the application of the Raritan River Railroad Company to issue capital stock. The company maintained that although it has succeeded in obtaining a reduction from the assessed valuation of $840,213 to $753,648, the former value should hold as the value of the property when making a valuation for the purposes of issuing stock. By the New Jersey constitution all property is taxable at its full value, and the commission stated that it could not assume, particularly in view of the petitioner's appeal from the assessment of the State Board of Assessors, that the value of the property was more than that finally held by the assessors.

## Corporate and Financial

**Allgemeine Elektricitäts Gesellschaft, Berlin.**—The intended increase in the capital of the Allgemeine Elektricitäts Gesellschaft of Berlin has received the support of the company's shareholders. The amount, however, has been somewhat reduced and an increase of only 29,000,000 marks ($7,250,000) was passed by the meeting, instead of the increase of 36,000,000 marks asked by the directors. Of the new issue 26,075,000 marks will be used for buying the stock of the Berliner Elektricitäts Werke, valued at 34,767,000 marks. The capital stock of the Allgemeine Elektricitäts Gesellschaft is now 184,000,000 marks.

**Carlisle (Ky.) Light & Power Company.**—The company recently increased its capitalization from $15,000 to $30,000.

**Central Maine Power Company, Augusta, Me.**—The company has filed petitions with the Public Utilities Commission asking that large purchases be approved by the commission. The company desires to acquire the Bath & Brunswick Light & Power Company, and a public hearing on the matter has been ordered by the commission. The company proposed to give to the holders of the capital stock of the Bath & Brunswick company in exchange for their holdings an equal value in 75 per cent cash and 25 per cent preferred stock of the Central Maine Power Company yielding 6 per cent, or 50 per cent of each at the option of the seller. The commission has already approved the purchase of the Waldoboro Water & Electric Light & Power Company.

**Cities Service Company, New York, N. Y.**—At a special meeting of the board of directors held on Nov. 10 the officers were authorized to sell $5,000,000 preferred and $2,500,000 common stock for $5,000,000 in cash. A strong syndicate of American interests has purchased this stock. The sale of this block of securities will enable the company to retire its entire floating debt and give ample working cash capital. Arrangements with purchasers provide that their stock will not be offered to the public at present, and purchasers may withdraw their stock from the syndicate only upon agreement that the preferred stock will be sold for not less than 85 and common at not less than 125. Holders of preferred stock of the company of record Dec. 15, 1915, will be given the right on Jan. 1, 1916, to receive 5 per cent convertible debentures of the company to the amount of 9 per cent of their holdings as payment for the deferred dividends to that date, the holder to have the right to convert these debentures at any time into stock upon a basis of $100 of preferred stock and $25 of common stock for each $100 in debentures. Holders of common stock will have 9 per cent in debentures

set aside for them and certificates will be issued to holders of record Dec. 15, 1915, which will entitle them to receive debentures when all holders of preferred stock have been paid their deferred dividends. The company will resume regular monthly dividends in cash on its preferred stock Feb. 1 to holders of record Jan. 15, 1916. A block of the company's 7 per cent notes due May 15, 1918, is now being offered at 101 and interest. These notes are part of an authorized issue of $10,000,000, of which $7,000,000 is now outstanding. The earnings of the company for the year ended Sept. 30, 1915, are as follows:

| | |
|---|---|
| Gross earnings | $4,121,622 |
| Expenses | 159,571 |
| Net earnings | $3,962,051 |
| Note interest | 490,000 |
| Balance | $3,472,051 |

**Citizens' Light, Heat & Power Company, Johnstown, Pa.**—The company has filed at the State Capitol a certificate of notification in the matter of issue of $150,000 of five-year 5 per cent gold notes. The notes are a part of an authorized issue of $300,000, none of which has been issued. They bear date of Feb. 1, 1915, and mature Feb. 1, 1920. It is understood that the company is planning some large extensions.

**Consolidated Gas, Electric Light & Power Company of Baltimore, Md.**—The New York Stock Exchange has admitted to be listed $11,472,300 common stock of the company, with authority to add $4,103,700 of common stock upon official notice of issuance in exchange for 6 per cent cumulative preferred stock, $2,174,000 upon official notice of issuance in exchange for two-year convertible 5 per cent notes of the company, $4,109,800 upon official notice of issuance in exchange for consolidated mortgage 5 per cent debenture stock or bonds of the company, $300,000 upon official notice of issuance on account of the acquisition of the capital stock of the Patapsco Electric & Manufacturing Company of Delaware and the capital stock of the Patapsco Electric & Manufacturing Company of Maryland, and $2,500,000 upon official notice of issuance and payment in full, making the total amount authorized to be listed $24,659,800.

**Great Falls (Mont.) Power Company.**—The New York Stock Exchange has admitted to be listed $4,750,000 of the company's first mortgage sinking-fund 5 per cent gold bonds, dated May 1, 1911, and payable May 1, 1940, being part of an authorized issue of $15,000,000. Additional bonds of this issue will not be sold to the public, but are to be acquired by the Montana Power Company, which owns all the outstanding stock excepting directors' shares, and deposited under its first and refunding mortgage. The company has recently completed a hydroelectric plant at the Great Falls of the Missouri with an initial rating of 60,000 hp. From this plant energy will be furnished to the eastern section of the newly electrified portion of the Chicago, Milwaukee & St. Paul Railway from Harlowton to Deer Lodge, Mont., a distance of about 230 miles. The income account for the twelve months ended Sept. 30, 1915, is as follows:

| | |
|---|---|
| Gross earnings | $1,448,293 |
| Net expenses and taxes | 439,710 |
| Net earnings | $1,008,583 |
| Dividends, interest and other income | 27,476 |
| Total net income | $1,036,059 |
| Interest charges | 205,133 |
| Net income after interest charges | $830,926 |
| Dividends paid | 717,963 |
| Net balance to surplus | $112,963 |

**Kansas City (Mo.) Railway & Light Company.**—A supplemental plan prepared by Judge Hook of the federal court at Kansas City names John H. Atwood of Kansas City and William W. Gurley of Chicago as commissioners to further the separation of the Metropolitan Street Railway and the Kansas City Electric Light Company and the establishment of the properties under new and separate ownership. The supplemental plan is more specific as to the separation of interests in the two companies. Trustees are to be elected by the stockholders of the street railway and the light company respectively, to whom all the stock of each shall be conveyed, and all the stock to be issued while the trustees are acting, except such as is to be sold to the public, shall be conveyed and issued to the trustees, who shall then issue to the stockholders becoming parties to the plan preferred and common beneficial certificates representing one unit of participation for each share of stock, the character of the share determining that of the certificate. The certificates shall have no specified par value. No holder of a certificate in one company shall thereby have any interest in the certificates or stock of the other company. The commissioners will have no authority to pass on claims, but shall merely report them to the court and to whichever of the new companies is affected by such claims.

**North Coast Power Company, Vancouver, Wash.**—This company, which was recently formed, with Clarence M. Brown as president, H. L. Harries as vice-president, L. J. Morris as secretary, and B. F. Donahue as treasurer, will take over, it is expected, the properties of the Washington-Oregon Corporation which were purchased by a representative of the bondholders at the foreclosure sale on Oct. 30. The holders of bonds of the old company, it is said, will receive general lien bonds of the new company to the extent of 40 per cent of their claims and preferred stock of the new company to the extent of 60 per cent of their claims, besides interest. The general creditors, it is thought, will participate in the common stock.

**Tennessee Power Company, Chattanooga, Tenn.**—No immediate operations are in prospect for Development No. 3 on the Ocoee River, in Tennessee, according to C. W. Clark of Philadelphia, president of the company, who, with F. W. Hoover and others, has just completed the semi-annual inspection of the properties. The company, it was stated, will complete its contract to construct a transmission wire from Development No. 2 to Ducktown, Tenn., about the first of the year, while it is expected that the steam plant being constructed at Parksville will shortly be completed. This will serve as an auxiliary to the water plant.

## Manufacturing and Industrial

**Frederick H. Poor** has recently severed his connection with the S K F Ball Bearing Company and has opened an office of his own at 30 Church Street, New York.

**L. W. Barnette**, who formerly was sales manager for the Franklin (Pa.) Steel Works, steel-pole manufacturers, is now sales engineer for the Bates Expanded Steel Truss Company of Chicago.

**The E-Z Mazda Lamp Lock Company.**—W. C. Woost has retired from the E-Z Mazda Lamp Lock Company, 19 Park Place, New York. The business of the firm will now be conducted by Hugh Davis and James Cook.

**The Metals Coating Company of America**, 122 South Michigan Avenue, Chicago, Ill., has opened an office at 30 Church Street, New York, which will be in charge of Edward McFarlan, and one at 100 Summer Street, Boston, Mass., which will be in charge of Herbert Jacques, Jr.

**The Overseas Engineering Company, Ltd.**, 75 Curtain Road, London, E. C., England, has sent one of its directors, Arthur Morris, to this country to confer with American manufacturers who would like to take advantage of its selling organization abroad to push their specialties. Mr. Morris is staying at the Astor Hotel, New York.

**The Safety-Armorite Conduit Company**, Bailey-Farrell Building, Pittsburgh, Pa., as noted in the ELECTRICAL WORLD of Nov. 13, has opened an office at 1670 Hudson Terminal Building, 50 Church Street, New York, which will be in charge of W. G. Campbell. Mr. Campbell will have charge of the company's interests in New York State and Philadelphia, Washington, Baltimore and the districts surrounding those cities.

**The Electric Controller & Manufacturing Company**, Cleveland, Ohio, has taken over the plant of the Van Dorn & Dutton Company, which adjoins its own plant. The Van Dorn & Dutton Company will continue to occupy the plant until its new factory at 2978 Woodhill Road, S. E., Cleveland, has been completed. The property taken over consists of two parcels, one 120 ft. by 160 ft. and the other 40 ft. by 160 ft. Both properties are occupied by brick structures.

**The Connecticut Telephone & Electric Company,** Meriden, Conn., has appointed P. P. Hinckley of Chicago as a member of its sales force. Mr. Hinckley will handle the company's jobbing trade east of Chicago. The company's jobbing connections in the West and Chicago will be in charge of J. W. Fulton, 1100 Karpen Building, Chicago, Ill.

**Laundrymen in Louisville Advising People to Use Electric Irons.**—Laundry owners of Louisville, Ky., are supporting sales of electric irons, according to a statement recently made by one of them. One might well imagine that laundry owners would oppose the use of electric irons, but it has been found that as a result of the increased use of this domestic utensil the volume of "rough-dry" work that the laundries are turning out is increased.

**The Van Dorn & Dutton Company,** Cleveland, Ohio, manufacturer of gears and pinions, has recently taken out building permits for the construction of three buildings, at an aggregate cost of approximately $80,000, at 2978 Woodhill Road, S. E., Cleveland. One of the structures is to be a machinery building to cost about $50,000; another building which will serve the same purpose as the one previously named will cost $25,000; the third building will be employed for experimental work and will entail an expenditure of $2,500.

**Hydroelectric Development Abroad.**—The Bureau of Foreign and Domestic Commerce has arranged to place unpublished manuscripts submitted by American consular officers in various countries, reviewing hydroelectric developments and the outlook for augmented sales of electrical materials and supplies in their respective districts, in industrial centers of the United States, where they can be inspected by manufacturers and exporters. Two sets of these manuscripts have already been distributed in this way. Additional reports have since been received from consular officers. They are known as Hydroelectrical Series No. 3, and will be made available to interested firms in the same manner as the two sets named above.

**The S K F Ball Bearing Company** of Hartford, Conn., which was recently incorporated under the laws of Connecticut for the purpose of taking over the business of the S K F Ball Bearing Company of New York, importer of ball bearings from Sweden, has appointed Frank A. Vanderlip a member of its board of directors. As already noted in the ELECTRICAL WORLD, the new company has acquired the right to manufacture the S K F ball bearings in America from the Swedish company and is about to erect a factory for the purpose at Hartford, Conn. The new company is capitalized at $2,000,000. Besides Mr. Vanderlip, the board will consist of B. M. W. Hanson, vice-president of Pratt & Whitney, Hartford; Franklin B. Kirkbridge, 7 Wall Street, New York; A. Carlander and S. Winquist, directors of the Swedish S K F company, which is a large stockholder in the new American corporation, and B. G. Prytz, who will act as president.

**Edison Lamp Works Publicity Helps for Electrical Prosperity Week.**—Among the prominent "boosters" of Electrical Prosperity Week are the Edison Lamp Works of the General Electric Company, Harrison, N. J., which are sending out a number of advertising helps for dealers, emphasizing the importance of the above-named period. Special window-display material has been prepared, the items for which include a window strip on one end of which appears the design of the goddess "Electra," the official insignia for Electrical Prosperity Week, and on the other a design called "His Only Rival" and two cut-out displays for the lower corners of the windows which show the progress in lighting in recent years. Blotters printed in four different colors to extend Electrical Prosperity Week publicity are also being sent out. The blotters are designed to fit standard-sized envelopes, so that they can be included in the dealer's outgoing mail. The Edison Lamp Works, in addition to the above-mentioned helps, are prepared to send out a number of different kinds of newspaper electrotypes which contain information on and direct attention to the significance of Electrical Prosperity Week.

**Important Changes in the Storage-Battery Field.**—Purchase of the Pumpelly Battery Company by the Prest-O-Lite Company, Inc., Indianapolis, was recently made with the idea of giving the latter concern immediate access to the automobile field and the boat field. Until the new battery plant of the Prest-O-Lite Company is completed at Speedway, Ind., production is being carried on at the downtown plant of the former Pumpelly Battery Company. The manufacturing facilities of the old Pumpelly Battery Company have been greatly increased, and the new plant now running twenty-four hours a day is producing 400 or 500 Prest-O-Lite batteries daily. Through the later purchase of the Brown-Smith Battery Company of Bloomington, Ind., the Prest-O-Lite Company acquired an organization experienced in the manufacture of heavy plate batteries suitable for lighting country homes and for propelling electric vehicles and submarines. Up to the present time, however, the Prest-O-Lite Company has made no effort to reach the three fields last named.

**Wide Use for Vacuum Cleaner on Farm.**—The Bissell Motor Company, Toledo, Ohio, has recently received a letter from D. Anderson & Sons, Sylvania, Ohio, stating that they are finding a number of uses to which a motor-driven cleaner can be put on the farm. For instance, a curry-comb attachment is employed for cleaning horses and cows. In part the letter says: "At the time of the purchase I bought with the cleaner a curry-comb attachment with the idea of currying the horses and cows, as well as using it for the original purpose of cleaning carpets, etc. We used it for this purpose until we found it necessary to put through our fanning mill about 800 bushels of oats that we had threshed damp. It took only a few minutes after we received a standard to attach it to the fanning mill, and we fanned at the rate of 60 bushels of oats per hour. We were not content to stop there, but having a horse-clipping machine on the farm, we also are running it with the cleaner. Then we had a flywheel of our cider press grooved for a round belt and hitched it to the vacuum cleaner for grinding up the apples." The cleaner referred to above is operated by a 1/3-hp. motor.

**The Electric Construction & Machinery Company,** Electric Building, Rock Island, Ill., has recently increased its capital stock from $50,000 to $75,000. This increase has been necessitated by the enlargement of the company's field of activity. J. T. Marron is president of the company, James Barclay vice-president and treasurer, and Robert Mitchell secretary. The company is very busy and is looking forward with much optimism to prospects of increased business next year. At this time the company is installing a new lighting plant at Wilton Junction, Iowa, and also an addition to the electric-lighting plant at Wayland, Iowa. It is building a 25-mile, 33,000-volt line from Dubuque to Dyersville, Iowa, and in connection with the installation is installing wiring systems in five towns, including street-lighting equipment. It is also rewiring the Catholic cathedral at Dubuque and is equipping St. Clara College at Sinsinewa Mount, Wis., with lighting and power apparatus. Other projects in which the company is engaged are the wiring of the new Y. M. C. A. Building at Galesburg, Ill., the new Christian Church at Galesburg, the new Lutheran Hospital at Moline, Ill., and the new Manual Training School at Davenport, Iowa. Another job of interest is a pole-line and power installation at Le Claire, Iowa.

## NEW YORK METAL MARKET PRICES

| | Nov. 9 Selling Prices Bid | Nov. 9 Selling Prices Asked | Nov. 16 Selling Prices Bid | Nov. 16 Selling Prices Asked |
|---|---|---|---|---|
| | £ s d | | £ s d | |
| London, standard spot | 74 2 6 | | 78 5 0 | |
| Prime Lake | 18.00 | to 18.25 | 18.62½ | to 18.87½ |
| Electrolytic | 18.00 | to 18.25 | 18.62½ | to 18.87½ |
| Casting | 17.50 | to 17.75 | 18.25 | to 18.50 |
| Copper wire base | 19.25 | to 19.50† | 19.75 | to 20.00† |
| Lead | 5.00 | | 5.25 | |
| Nickel | 45.00 | to 50.00† | 45.00 | to 50.00 |
| Sheet zinc, f.o.b. smelter | 16.50† | | 18.00† | |
| Tin, Straits | 36.50† | | 42.75† | |
| Aluminum, virgin, 99 per cent | 56.00 | to 58.00† | 58.00 | to 60.00† |

## OLD METALS

| | | | | |
|---|---|---|---|---|
| Heavy copper and wire | 15.00 | to 15.25† | 15.50 | to 15.75† |
| Brass, heavy | 10.00 | to 10.25† | 10.50 | to 10.75† |
| Brass, light | 8.50 | to 9.00† | 9.00 | to 9.25† |
| Lead, heavy | 4.37½ | to 4.47½† | 4.60 | to 4.65† |
| Zinc, scrap | 10.50 | to 11.00† | 13.00 | to 13.25† |

## COPPER EXPORTS

Total tons to Nov. 16 ..... 9,825

†Nominal.

## New Incorporations

**The Cisne Electric Light Company,** Cisne, Ill., has been incorporated with a capital stock of $5,000 by C. B. Clay, Nellie Clay and John H. Brown. The company proposes to supply electricity for lamps and motors in Cisne.

**The Lampasas Light & Power Company,** Lampasas, Tex., has been organized by Emil P. Haby, T. S. Alexander and E. Haby, Sr. The company is capitalized at $8,000 and will construct an electric light and power plant in Lampasas.

**The Rio Grande City Ice, Water & Light Company,** Rio Grande, Tex., has been organized with a capital stock of $24,000 to construct and operate a water and light plant and ice factory in Rio Grande. R. R. Margo is interested in the company.

## New Industrial Companies

**The Electric Shop, Inc.,** St. Paul, Minn., has filed articles of incorporation with a capital stock of $15,000. The officers are: Thomas Hall, president; R. M. Laird, vice-president, and J. E. Bryan, secretary, all of St. Paul.

**The Domestic Electric Company,** Cleveland, Ohio, has been incorporated with a capital stock of $17,000 by Harry T. Gettins, R. C. Soden, H. C. Wood, Leo R. Green and L. N. McDonnell. The company intends to do a general manufacturing business.

**The Chiriqui Electric Corporation,** New York, N. Y., has been incorporated with a capital stock of $150,000 by J. A. Stapleton, G. Jameson and F. R. Owen, 8-10 Bridge Street, New York, N. Y. The company purposes to do a general electrical and mechanical engineering business and to deal in dynamos, motors, etc.

## Trade Publications

**Barometric Condensers.**—The Mesta Machine Company, Pittsburgh, Pa., has published Bulletin R on several types of its barometric condensers.

**Glazing Construction.**—"Waugh Glazing Construction" is the title of Bulletin No. 56 issued by the Asbestos Protected Metal Company, Pittsburgh, Pa.

**Soldering Paste.**—"Soldering Kinks" is the title of a catalog issued by the M. W. Dunton Company, Providence, R. I., on its "Nokorode" soldering paste.

**Portable Vise and Pipe Bender.**—H. P. Martin & Sons, Owensboro, Ky., have issued an illustrated bulletin on portable device for threading, cutting and bending pipe.

**Jeweler's Lathe Motor.**—The Hamilton-Beach Manufacturing Company, Racine, Wis., has prepared an illustrated leaflet describing its electric jeweler's lathe motor.

**Conduit Fittings.**—Catalog No. 105, prepared by the Adapti Manufacturing Company, Cleveland, Ohio, contains information on a number of different types of conduit fittings.

**Semi-Indirect Lighting Fixtures.**—The Frank Adam Electric Company, St. Louis, Mo., is sending out a folder which contains some engineering data on its semi-indirect-lighting unit.

**Electric Household Devices.**—The Simplex Electric Heating Company, Cambridge, Mass., has recently prepared several illustrated booklets on its electric cooking and heating appliances.

**Electric Air Heaters.**—Type D air heaters are the subject of an illustrated folder recently published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

**Portable Electric Heater.**—The American Electrical Heater Company, Detroit, Mich., is sending out two folders illustrated in colors which describe its "American Beauty" electric radiator.

**Receptacles for Semi-Indirect Lighting.**—The Luminous Unit Company, St. Louis, Mo., has prepared a folder which illustrates and describes several of its receptacles for its "Brascolite" fixtures.

**Buffing and Polishing Machinery.**—Bulletin No. 700, prepared by the Munning-Loeb Company, Matawan, N. J., is illustrated and contains information on buffing, polishing and burnishing machinery.

**Ball Bearings for Overhead Shafts.**—The S K F Ball Bearing Company, 50 Church Street, New York, has prepared an illustrated folder which contains information on self-aligning ball-bearing hangers.

**Automatic Cut-Off and Non-Return Valves.**—The Lagonda Manufacturing Company, Springfield, Ohio, has just published a twenty-four-page bulletin on its triple-acting automatic cut-off and non-return valves.

**Battery-Charging Equipment.**—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has prepared Booklet B, which contains illustrations of and information on its universal-type garage equipment.

**Outlet Boxes and Covers.**—A booklet containing illustrations of and information on a number of different types of outlet boxes and covers has been prepared by the Chicago Fuse Manufacturing Company, Chicago, Ill.

**Dish Washers.**—Several types of electrically operated dish washers for home and restaurant use are described and illustrated in a thirty-one-page catalog issued by the Walker Brothers Company, Syracuse, N. Y.

**Industrial Motor Applications.**—A booklet designated as Envelope Series No. 4043, issued by the British Westinghouse Electric & Manufacturing Company, Trafford Park, Manchester, England, is illustrated and contains information on industrial motor applications.

**Motor-Driven Portable Sewing Machine.**—The Wilcox & Gibbs Sewing Machine Company, 658 Broadway, New York, has issued an illustrated leaflet which contains information on its small portable sewing machine, which is operated directly by a Westinghouse motor.

**Adjustable Lighting Fixture.**—The Simplexlite Company, 138 West 116th Street, New York, is sending out an illustrated folder which describes and illustrates a unit for commercial semi-indirect lighting the glass shade of which can be moved up or down by means of wing nuts.

**Electrically Operated Apparatus for Painting Without Brushes.**—The Paasche Air Brush Company, 9 South Clinton Street, Chicago, Ill., has issued an illustrated folder which contains information on its improved type of inclosed hood and electrically operated apparatus for applying paint and other liquid materials on various kinds of surfaces.

**Battery-Operated Devices and Electric Appliances.**—The Lincoln Electric Works, 112 West Adams Street, Chicago, Ill., have issued leaflets on their electrically illuminated cane and umbrella, No. 605 portable lamp with silk shade, No. 611 portable lamp with inverted-light effect, No. 759 "Boy Scout" electric lantern, No. 33 "Marvel" electric toaster, trouble lamp, pocket flash pencil, "Uncle Sam Mail Box" electric lantern, No. 630 "Night Light," and No. 77 round toaster and heater.

**Electrical Apparatus.**—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is sending out sections of its Catalog No. 3001, on porcelain and glass insulators, pole-line hardware, cross-arms, insulator pins, etc., railway-type switches, field switches, type F oil circuit-breakers, fuse blocks for inclosed fuses, Benjamin fixtures for nitrogen-filled multiple lamps, "series Mazda" regulating transformers and control panels, curve analyzing and recording devices, type D inverse-time-limit reverse-current relays, and oil drying and purifying outfits.

**Electric Sign Systems and Lighting for Insurance Companies and Banks.**—The H. W. Johns-Manville Company, Forty-first Street and Madison Avenue, New York, has issued Catalog No. 416, which contains a large number of attractive illustrations of and information on "Frink Polaralite" signs, the source of illumination of which is entirely hidden, the light being reflected up or down edgeways through the glass. The company has also just published Catalog No. 415, entitled, "J-M Lighting Service for Insurance Companies and Banks." The catalog contains a large amount of information on reflectors and lighting systems made by the I. P. Frink Company and lighting fixtures by the Mitchell Vance Company, for which the H. W. Johns-Manville Company is sole selling agent.

# Construction News

## New England

TURNER, ME.—The Public Utilities Commission has granted the Turner Lt. & Pwr. Co. permission to extend its transmission lines to Buckfield and furnish electrical service in that place.

ATTLEBORO, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 21, for the construction complete, including mechanical equipment and approaches, of the United States post office at Attleboro, Mass.

HULL, MASS.—The Weymouth Lt. & Pwr. Co., East Weymouth, has submitted a proposal to the town of Hull offering to purchase the municipal electric-lighting plant at $115,311. It also agrees to erect a duplicate transmission line from Weymouth, to keep the present plant in Hull in readiness for use as a reserve plant, and to furnish electricity for lighting the public buildings at $816 per annum, and for street lamps at $9,483, the service to be the same as now furnished, for a period of five, ten or more years.

NARRAGANSETT PIER, R. I.—The Narragansett Pier El. Lt. & Pwr. Co. has been granted a franchise to erect and maintain electric transmission lines from Kingston Village along the highway to West Kingston to Park Avenue, thence to the old Kingston Road, and on to the village of Usquepaugh.

## Middle Atlantic

ALBANY, N. Y.—The contract for the lighting fixtures for the new county court house for Albany County has been awarded to the Haven Electrical Co., Albany, at $27,638.

AMSTERDAM, N. Y.—Application has been made by the Edison El. Lt. & Pwr. Co., Amsterdam, to the Public Service Commission for permission to issue $327,000 in additional capital stock and $350,000 in bonds.

DELEVAN, N. Y.—The installation of an electric-lighting system in Delevan is under consideration. It is proposed to secure energy from the municipal electric plant in Arcade.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Nov. 23 for additions and alterations to power house and for power-house equipment, etc., at the Middletown State Homeopathic Hospital, Middletown. Drawings and specifications may be consulted at the Middletown State Hospital, Middletown; at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, New York, N. Y., until Nov. 23, for furnishing, under Schedule 753, 100 recording charts, one brass cylinder, one electric drill, one Boyer gear, one chemical fire engine, 100 pairs of rack insulators, 3000 insulated nails, 112 cross-arm pins, one knife switch, two transformers, one wattmeter, and 3100 ft. solid conductor wire. Col. A. L. Smith is depot quartermaster.

NEW YORK, N. Y.—Bids will be received by Marcus M. Marks, Borough President, Room 2032, Municipal Building, New York, until Nov. 23 for furnishing all material and labor for additions and alterations to the electric-lighting system on the sixth, seventh and eighth floors of the Hall of Records Building, Borough of Manhattan. Blank forms, specifications and plans may be obtained at the office of the auditor, offices of commissioner of public works, Room 2141, Municipal Building.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Nov. 29 for furnishing equipment for the vocational school for boys, 138th Street, near Fifth Avenue, as follows: Item (2) monotype machine parts; (3) flasher equipment; (4) electric apparatus; (5) printing press, paper cutter, etc.; (6) electric materials. A separate bid must be submitted for each item. Blank forms, plans and specifications may be seen or obtained at the above office and also at the branch office, 69 Broadway, Flushing, borough of Queens.

OSWEGO, N. Y.—The Public Service Commission has granted the Niagara, Lockport & Ontario Pwr. Co., Buffalo, permission to erect a transmission line across the West River Road in Oswego. The line is necessary to enable the company to carry out a contract for furnishing energy to the Syracuse, Lake Shore & Northern line of the Empire United Railways.

PERRYSBURG, N. Y.—The Town Board has granted the Gowanda Lt. & Pwr. Co., Gowanda, a franchise to extend its transmission line to Perrysburg to supply electrical service here. Work will soon begin on the erection of the line.

SAG HARBOR, N. Y.—The power plant of the Sag Harbor El. Lt. & Pwr. Co. was recently damaged by fire.

WARREN, N. Y.—The Council has granted the Warren Lt. & Pwr. Co. a perpetual franchise. The company, it is reported, contemplates extensive improvements to its plant.

EASTON, PA.—Plans are being prepared for the erection of a new building for the Easton Hospital to cost about $100,000. William H. Michler, Easton, is the architect.

MAUCH CHUNK, PA.—Plans are being considered, it is reported, by the Carbon Transit Co., Mauch Chunk, for enlarging and concentrating its power plants. New equipment, including a 250-hp. boiler and a 300-kw., 600-volt direct-current generating unit, willl be installed.

NEW BRIGHTON, PA.—Plans are being considered by the Borough Council for the installation of a municipal electric plant. Estimates submitted to the Council by the Westinghouse El. & Mfg. Co. place the cost at $57,175.

PHILADELPHIA, PA.—The Midvale Steel Co. is planning to erect a large brick and concrete machine shop in Nicetown, a suburb of Philadelphia. The building, it is reported, will be equipped throughout with electrically driven machinery.

PHILADELPHIA, PA.—The Baldwin Locomotive Works, it is reported, will erect a four-story shop for the manufacture of electric trucks at its plant at Eighteenth and Buttonwood Streets, Philadelphia. F. Jasperson is engineer in charge.

PHILADELPHIA, PA.—The American Pulley Co. is planning to erect a three-story brick, stone and concrete building for employees at its plant at Nicetown, a suburb of Philadelphia. The electrical installation will be included in the general contract. Ballinger & Perrot, Philadelphia, are architects.

PITTSBURGH, PA.—The Aluminum Co. of America, Pittsburgh, is reported to have taken over the extensive projects under way near Whitney and Badin, N. C., which include the damming of the Yadkin River, the installation of a large hydroelectric power plant, an electrolytic plant for the production of metallic aluminum, an electrode factory, works for the purification of alumina, the erection of houses for employees, and other buildings necessary for the undertaking.

POTTSVILLE, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8, for the installation of an electric freight elevator, etc., in the United States post office at Pottsville. For details see proposal columns.

WEST HAZLETON, PA.—Bids will be received until Dec. 8 for lighting the borough of West Hazleton with electricity for a period of ten years. Specifications are on file in the office of William Krapf, secretary, 107 North Broad Street, West Hazleton.

CAMDEN, N. J.—Plans are being considered by the City Commission for the installation of new street lamps. The Public Service El. Co. has been requested to erect several different types of lighting fixtures for demonstration purposes.

CAMDEN, N. J.—The Board of Education has appointed Paul A. Davis, Philadelphia, Pa., architect for the new Parkside High School, to be erected at a cost of $400,000. The plans provide for an electric plant, boiler rooms and a complete manual-training department.

CAMDEN, N. J.—Arrangements are being made by the Victor Talking Machine Co., it is reported, for the erection of one four-story and one six-story reinforced-concrete and steel building at its plant in Camden. Special attention will be given to the electrical equipment. Ballinger & Perrot, of Philadelphia, Pa., are architects.

KEYPORT, N. J.—The Jersey Central Trac. Co., Keyport, is planning to erect a new substation at Stone Church to replace the portable one now in use. The new station will supply energy in Highlands and adjacent towns.

MAGNOLIA, N. J.—Bids will be received by the Borough Council until Dec. 31 for lighting the streets of the borough for a period of five years. C. E. Hagen is borough clerk.

WOODRIDGE, N. J.—The Township Committee has granted the Port Reading R. R. Co. a franchise to erect and maintain an electric transmission line along the Turtle Brook Road.

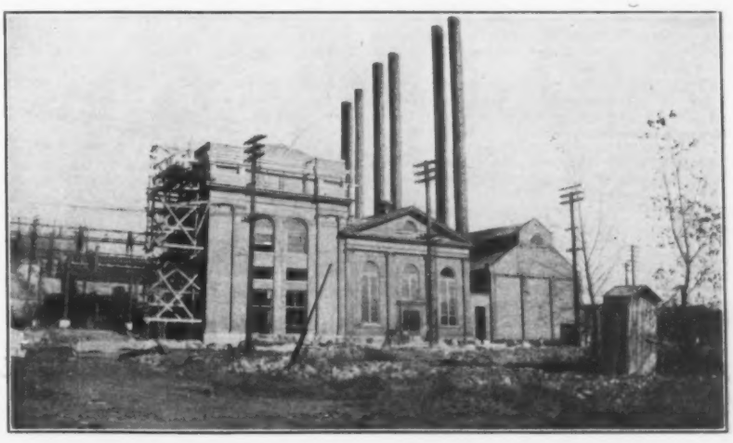
FENWICK, W. VA.—The installation of an electric-light plant in Fenwick is reported to be under consideration by the City Council.

PENNSBORO, W. VA.—The Pennsboro Ice & Pwr. Co., recently incorporated with a capital stock of $25,000, is planning to build an electric plant in Pennsboro, to cost about $25,000. The equipment will include one 100-kw., three-phase, 2200-volt generator and a natural-gas engine. H. E. Hopkins is manager.

## Water-Power to Supplant Madison (Wis.) Steam Station

A transmission line now being built from Prairie du Sac to Madison, Wis., passing through the towns of Lodi, Dane and Mendota, will soon be supplying power from the hydroelectric plant at Prairie du Sac through a new substation at Madison to the patrons of the Madison Gas & Electric Company. The existing steam station at Madison contains two steam turbines with an aggregate rating of 4540 hp. and several smaller reciprocating units. With the new substation in operation it is planned that this apparatus shall be held in reserve. Boiler fires will be kept banked at all times so that the load may be picked up quickly in an emergency. The ground area occupied by the new substation is about one-sixth that covered by the old power plant. To assure reliability of the water-power service the 33,000-volt line from Prairie du Sac has been made a double circuit. Steel-cored aluminum wire was used for the high-tension lines as well as for a circuit of lower potential which is strung on lower arms and is feeding the small towns and the farms and dwellings of rural customers along the right-of-way.

Except in the city, where latticed steel poles are used, the line supports are square-based steel towers.



ALEXANDRIA, VA.—The Council has authorized the light committee to enter into a contract with the Alexandria County Ltg. Co. to install 43 additional lamps of 40 cp. in the recently annexed territory.

NORFOLK, VA.—The Tidewater Knitting Mills contemplate substituting electricity for steam as motive power.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Dec. 6, for furnishing and erecting at the District pumping station, Washington, D. C., one fuel economizer. Specifications may be obtained upon application to the purchasing officer, District Building.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 30 for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 8980—114 ft. leather belting; Schedule 8989—two 14-in. by 6-ft. lathes (cone drive). Boston, Mass., Schedule 8991—one cylindrical surface condenser. Brooklyn, N. Y., Schedule 9001—miscellaneous conduit steel, miscellaneous interior-communication cable, 700 radio headgear receiver cords, miscellaneous magnet wire, miscellaneous rubber-insulated wire ignition circuits, miscellaneous single-conductor wire, miscellaneous twin-conductor wire; Schedule 8999—miscellaneous single-stranded, rubber-covered wire, 10,000 ft. duplex telephone wire; Schedule 9003—miscellaneous steam plug cocks, miscellaneous composition unions, miscellaneous composition pipe fittings; Schedule 8982—60 copper expansion joints. Philadelphia, Pa., Schedule 9003—700 steel boiler tubes. Bids will also be received until Dec. 7, as follows: Mare Island, Cal., Schedule 8987—one gas-producing apparatus; Schedule 8978—miscellaneous steel tubing; f.o.b. Schedule 9009—one high-speed, seaworthy motorboat. Applications for proposals should give the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 19,178—A telephone company in Norway wishes to purchase 3000 kegs (6,613.86 lb.) of silicium bronze wire (the diameter should be 1.3 mm. (0.051181 in.), with 40 per cent minimum conductivity) and 70 kegs (154.3234 lb.) minimum breaking strain per square mm. (0.03937 in.), the wire being according to British post-office specifications. Correspondence in English. Definite terms are wanted. No. 19,191—An American consular officer in the Canary Islands reports that a firm desires to purchase a number of electrically driven water pumps and motors. Prices c.i.f. port of entry, if possible. No. 19,204—A commission firm in Argentina has informed an American consular officer that it wishes to secure the representation of American manufacturers and exporters of lumber, iron products, wire, copper, leather, cement, etc. Correspondence should be in Spanish. No. 19,218—A report from an American consular officer in India states that a business man in his district desires to communicate with manufacturers of electrical goods. Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branch offices.

## North Central

GRAND RAPIDS, MICH.—The Citizens' Tel. Co., with plants in Grand Rapids, Jackson and Lansing, has applied to the State Railroad Commission for permission to issue $100,000 in bonds, the proceeds to be used for general development and improvements to its systems.

CINCINNATI, OHIO.—Bids will be received by C. W. Handman, business manager of the board of education, until Dec. 13 for work involved in the remodeling of the Fulton public school building, including the electrical work throughout. Plans and specifications are on file in the office of the board at 511 West Court Street.

GREENSPRING, OHIO. — Preparations are being made by the Greenspring El. Lt. & Pwr. Co. to discard the present generating equipment, consisting of direct-current generators and oil engines, and to purchase energy from the Ohio Lt. & Pwr. Co., Newark, to operate its system, to be delivered at Old Fort. The Greenspring company will supply electrical service in Old Fort and erect a transmission line from that place to its plant in Greenspring. The substation will be installed in Old Fort. The new equipment will include three 20-kva, three-phase, 6600/110/220-volt transformers, and switchboard for alternating-current 60-cycle service. Material for overhead will include 6 miles of No. 6 bare wire for three-wire, three-phase, 6600-volt line, and wooden poles. D. M. Scott is manager and engineer in charge.

LOWELLVILLE, OHIO.—Work has begun on the construction of the extension of the generating station of the Youngstown & Sharon St. Ry. Co., a subsidiary of the Republic Ry. & Lt. Co. The plans provide for the addition of four bays to the boiler and turbine rooms. The equipment to be installed at this time will include five 600-hp. Babcock & Wilcox boilers with superheaters and stokers, one forced-draft fan and engine, one General Electric 15,000-kw., 2300-volt generator, one 200-kw. combination motor and turbo-driven exciter set, three General Electric 3125-kva. step-up transformers, one 1000-gal. feed pump, condensing equipment, separate screen well and intake tunnel, and a coal bunker for the entire length of the boiler room, with ash hoppers, chutes, etc. The Stone & Webster Engineering Corpn., Boston, Mass., has the contract for the work.

SPRINGFIELD, OHIO.—The extension of the ornamental lighting system along Mount Vernon Avenue is reported to be under consideration.

LOUISVILLE, KY.—The general contract for the construction of the new building for the Western Union Teleg. Co. in Louisville, to cost from $40,000 to $50,000, has been awarded to the Alfred Struck Co. The plans provide for an elaborate wiring system. Joseph & Joseph, Louisville, are architects.

LOUISVILLE, KY.—Plans for the equipment of the large dairy plant to be erected by D. H. Ewing's Sons in Louisville provide for 22 motors, aggregating 110 hp. The company, it is expected, will purchase an engine and generator, using its own steam plant. J. B. Hutchings, Columbia Building, Louisville, is architect.

MATER, KY.—Arrangements are being made by Wiley W. Gibson, Mater, for the installation of an electric-light system here. The proposed power station will be erected in Whitesburg, and the equipment will consist of one 110-volt or 125-volt direct-current generator and single switchboard and circuit-breaker for above; 6000 ft. of No. 4 insulated wire and about 5000 lamps of 16 cp. will be used. E. A. Lassiter, Mater, is engineer in charge.

MAYFIELD, KY.—The city of Mayfield has recently voted to issue bonds for the purchase of the electric-light plant and water-works system of the Mayfield Wtr. & Lt. Co.

PROVIDENCE, KY. — Bonds to the amount of $20,000 have been voted for the installation of a municipal electric-lighting plant. Negotiations will probably be opened with the Providence El. Lt. Co., which is now operating in this city without a franchise. The company is supplying individuals only, the city being unable to make satisfactory arrangements with it for street lighting.

BATTLE GROUND, IND.—The Fort Wayne & Northern Indiana Trac. Co., Fort Wayne, has entered into a contract with the Battle Ground Lt. & Pwr. Co. to supply the latter with electricity for a period of 25 years. Energy will be taken from the high-tension wires at Buck Creek. The Battle Ground company will erect the line between here and Buck Creek.

BICKNELL, IND.—Work will begin immediately, it is reported, on the large electric light and power plant to be erected at Apraw Ferry, 2 miles south of Bicknell. The company also proposes to build an interurban electric railway between Washington and Linton via Apraw, Wheatland, the Indian Creek, American and Freeman mines, through Bicknell, Frelandville, Pleasantville and Dugger. Options on the right-of-way, it is understood, have been taken. The proposed plant will supply energy to operate the railway and machinery in the mines and also to towns and cities within a radius of 100 miles. A. L. Brocksmith, Bicknell, is interested in the project.

KOKOMO, IND.—The Indiana Rys. & Lt. Co., Kokomo, is erecting 12 miles of 6600-volt transmission line, connecting its present lines with Hillisburg, Circleville and Kempton, and is also installing a distributing system in each of the three towns. P. H. Palmer is assistant general manager and chief engineer.

LAFAYETTE, IND.—The County Commissioners have appropriated $1,000 for the installation of ornamental lamps around the county court house.

MISHAWAKA, IND.—The installation of ornamental lamps on Edgewater Drive is under consideration.

NASHVILLE, IND.—Bonds to the amount of $7,000 have been voted for the installation of a municipal electric-light plant. Kerosene lamps are now used for lighting the streets.

PERU, IND.—The Public Service Commission has granted the Peru El. Lt. & Wtr. Co. permission to extend its transmission lines 1¼ miles on Paw Paw Pike to serve a large cold-storage plant near Peru. Authority was also granted the company to extend its lines to Bloomfield, an outlying suburb of Peru.

MACOMB, ILL.—The Home El. Construction Co., Macomb, has secured the contract for electrical work in the new post office building at Beardstown, Ill.; also a contract for installing an electric-light system in the city of Bushnell, consisting of 39 ornamental standards, carrying five-lamp clusters, and an electric elevator for the St. Francis Hospital at McComb.

MOLINE, ILL.—Plans are being considered for the construction of an electric railway from Moline to Coal Valley, with possibility of extension to Galva and Cambridge.

PEORIA, ILL.—The Public Utilities Commission has granted the Central Illinois Lt. Co., Peoria, a franchise to erect a 13,200-volt transmission line between Maquon and Yates City, in Knox County.

ST. FRANCISVILLE, ILL.—The City Council is considering the installation of a municipal electric-lighting plant and would like to engage an engineer to supervise the construction of the plant and to take charge of it after it is completed. M. Sparke is city clerk.

BELOIT, WIS.—The City Council has passed over the veto of Mayor H. W. Adams the ordinance providing for the installation of an ornamental lighting system in the business district of the city.

EAU CLAIRE, WIS.—Plans have been completed for the Paint Creek development near Chippewa Falls for the Wisconsin-Minnesota Lt. & Pwr. Co., and contract for earth excavation has been awarded to A. Guthrie & Co., St. Paul, Minn. The equipment of the proposed plant will include three 5000-hp. waterwheels, operating under 60-ft. head; 5000-kw., 60-cycle, 13,200-volt generators; switchboard equipment for 13,200 volts and 110,000 volts with remote control; bank of three 7500-kva., 120,000/110,000-volt, 60-cycle transformers, and one spare unit. Switching station will form a part of the generating station; 550 steel towers and 300 miles of No. 2-0 B. & S. gage copper wire will be required for overhead line; switchboard station meters will also be required. When completed the plant will supply energy to the H. M. Byllesby Co. at St. Paul, Minn. All contracts, except for excavation, are yet to be awarded. The Fargo Engineering Co. has charge of the engineering work for dam, buildings, etc. G. W. McIver is engineer in charge of equipment, including waterwheels, generators and electrical machinery.

FOX LAKE, WIS.—The Council has passed a resolution granting the Fox Lake Lt. & Pwr. Co. permission to install and operate an electric-light plant in Fox Lake.

LOWELL, WIS.—Plans have been prepared by the Lowell Lt. & Pwr. Co., recently organized, for the installation of an electric-light plant in Lowell, to cost about $10,000. The equipment will include two boilers, with rating of 100 hp. each, and two generators, direct-current and alternating-current, 2300 volts. Webster F. Pease, Lowell, is engineer in charge.

MEDFORD, WIS.—Extensive improvements are being made to the plant of the Medford Lt. & Htg. Co., including the construction of a new powerhouse, 28 ft. by 46 ft. Contracts have been placed for a 170-hp. Busch-Sulzer Diesel oil engine and a 150-kva. General Electric three-phase generator, directly connected, and switchboard made by the Northwestern El. Co. The present system, 133 cycles, single-phase, 1500 volts, will be changed and some line changes will be made. William Ungrodt is superintendent.

MERRIMACK, WIS.—The Council has granted a franchise to A. M. Farnsworth to install an electric plant in Merrimack.

NEENAH, WIS.—The installation of an ornamental lighting system in the business district is reported under consideration.

BUTTERFIELD, MINN.—The project to install an electric-lighting system in Butterfield, we are informed, has been postponed until next spring.

PLUMMER, MINN.—The installation of a municipal electric-light plant in Plummer is under consideration.

TRACY, MINN.—Emil W. Erick is reported to have been granted a franchise to install an electric-light plant.

LANYON, IOWA.—The Central Iowa Lt. & Pwr. Co., Fraser, has applied to the State Board of Railroad Commissioners for a franchise to construct and operate a transmission line in the town of Lanyon.

MASON, IOWA.—The Western El. Tel. Co. is contemplating the construction of a new building, to cost about $50,000.

POCAHONTAS, IOWA.—The town of Pocahontas has entered into a contract with the Humboldt Pwr. Co. for energy to operate the municipal electric-light system. A short line is being erected to connect with the company's line which already runs through the town.

WASHINGTON, IOWA.—The Washington Tel. Co. is planning to erect a new telephone building, to cost about $25,000.

KANSAS CITY, MO.—The contract for the installation of the lighting fixtures in the new tuberculosis hospital of Kansas City has been awarded to the Satterlee El. Co., Kansas City, Mo.

ST. LOUIS, MO.—The Cupples Station Lt., Ht. & Pwr. Co., 750 Railway Exchange, St. Louis, is installing a 750-kw. General Electric direct-current turbo-generator set. E. S. Billings is general superintendent.

SCHELL CITY, MO.—The city of Schell has granted E. T. Hartje a franchise to install and operate an electric-light plant for a period of 20 years.

TRENTON, MO.—Improvements involving an expenditure of about $100,000 are contemplated by the Trenton Gas & El. Co., which will include the erection of a new power station (41 ft. by 36 ft.), the installation of new generators and fuel-oil engines. The gas plant is to be remodeled and extended, at a cost of $25,000, and an ice factory built, at a cost of $36,000.

SHEYENNE, N. D.—An electric-lighting plant is being installed in Sheyenne. A. F. Hillstrom and W. H. Glass are interested in the project.

STANTON, N. D.—Application has been made to the Town Board for a franchise to install an electric-light system in Stanton.

TOLLEY, N. D.—Arrangements are being made by the Haynes-Porter Co. for the installation of an electric-lighting plant in Tolley.

WILLISTON, N. D.—It is reported that plans for an ornamental lighting system have been approved.

ASHTON, S. D.—Preparations are being made by the Spink County Pwr. Co., Ashton, for the construction of an electric-light plant here. The equipment of the proposed plant will include one 120-hp. Busch-Sulzer Brothers Diesel engine, one 100-kva., three-phase, 60-cycle, 6600-volt generator, two-panel switchboard, three 5-kva. and three 7½-kva., 6600/110/220-volt transformers, for which contracts, it is understood, have been awarded. One substation will be erected in Mellette; later substations will be built in Athol, Northville, Frankfort, Conde and Turton. The street-lighting system will consist of eleven 300-watt and 39 100-watt type "C" lamps. Hugh Triplett, Redfield, S. D., is engineer in charge.

LETCHER, S. D.—The Schuller El. Co. has been granted permission to erect transmission lines along the public highways in Sanborn County.

WINNER, S. D.—Application has been made by Floyd D. Hunt, Chicago, Ill., for a franchise to install and operate an electric-lighting plant in Winner.

HARTINGTON, NEB.—The electric light and power plant of the Hartington El. Co. has been taken over by S. B. Knudson, St. Paul, Minn. B. Cummins, St. Paul, Minn., has been appointed manager.

KANSAS CITY, KAN.—The new 5000-kw. generating unit at the municipal electric-light plant was put into service on Nov. 8. A new 6-mile, 66,000-volt service circuit has recently been completed. Another 5000-kw. generating unit will probably be purchased next year, bids to be asked about Jan. 1.

PERRY, KAN.—Bonds to the amount of $5,000 have been voted for the purchase of additional equipment for the municipal electric-light plant.

## Southern States

WATKINSVILLE, GA.—At an election to be held Nov. 22 the proposal to issue bonds to install an electric-lighting system will be submitted to the voters.

CLEARWATER, FLA.—The County Commissioners of Pinellas County have granted J. N. and J. M. McClung, Clearwater, a franchise to construct and operate an electric lighting, heating and power system in Clearwater and nearby cities.

DE LAND, FLA.—The De Land El. Lt., Pwr. & Ice Co. contemplates the installation of electric lamps from De Land to De Land Junction, a distance of several miles. The company also proposes to install ornamental lamps a short distance along Woodland Boulevard.

FORT PIERCE, FLA.—The City Council has passed an ordinance providing for an issue of $25,000 in bonds, the proceeds to be used for extension to the electric-lighting system and other municipal improvements.

CHATTANOOGA, TENN.—The Central Pwr. Co., recently incorporated with a capital stock of $50,000, has applied for a franchise to build an interurban electric railway from Chattanooga to Cleveland, Tenn., a distance of about 25 miles. G. B. Adams, M. N. Whitaker and J. L. Foust are among the incorporators.

HENDERSON, TENN.—Bids will be received by the Board of Mayor and Aldermen until Dec. 3 for sewerage and water-works construction. The water-works consist of approximately 5 miles of 4-in. to 8-in. cast-iron water pipe, 44 hydrants, 43 valves with boxes, and pumping station with oil engine and motor-driven pumps. Plans and specifications may be obtained from Frank L. Wilcox, engineer, Syndicate Trust Building, St. Louis, Mo., upon deposit of $15; specifications only, $5 deposit, and any one plan, $5 deposit.

HUMBOLDT, TENN.—Bids will be received at the office of the supervising architect, Washington, D. C., until Dec. 20, for the construction complete, including mechanical equipment and approaches, of the United States post office at Humboldt, Tenn.

McCOMB, MISS.—The McComb & Magnolia Lt. & Ry. Co., recently incorporated, has purchased the plant of the McComb City El. Co. The new company, it is reported, contemplates the construction of a power plant in connection with the proposed interurban railway, H. W. Bell, Laurel, is engineer.

CLEVELAND, OKLA.—An election will probably soon be called to submit to the voters the proposal to issue $125,000 in bonds for the proposed water-works system. The work will require 50,000 ft. of 4-in., 6-in., 8-in. and 10-in. cast-iron pipe for distribution system; 19,000 ft. 10-in. pipe for flow line; 150,000-gal. elevated tank on 80-ft. tower, a 3-mile transmission line, two 500-gal.-per-minute motor-driven centrifugal pumps, 1,000,000-gal. mechanical filtration plant, and a dam 390 ft. long and 25 ft. high for pipe line crossing the Arkansas River. A. C. Moore, Joplin, Mo., is consulting engineer.

GOLTRY, OKLA.—The Benham Engineering Co., Oklahoma City, has been engaged by the Board of Trustees to prepare plans and estimates of cost for an electric-lighting system, and also to make an appraisal of the local telephone system. The city contemplates the purchase of the telephone system.

WESTVILLE, OKLA.—An election will soon be called to submit to the voters the proposal to issue $10,000 in bonds for improvements and extensions to the municipal electric-lighting plant.

McKINNEY, TEX.—The City Commission has sold the municipal electric plant to the Texas Pwr. & Lt. Co., Dallas, subject to the approval of the voters. Under the terms of the sale the company is to supply the city with natural gas and to furnish 40 additional street lamps.

ONALASKA, TEX.—The electric light and power plant and other departments of the West Lumber Co., recently destroyed by fire, will be rebuilt.

PLAINVIEW, TEX.—Preliminary steps have been taken by Judge I. R. Kelso, St. Louis, Mo., and associates for the construction of a large electric generating station in Plainview. The syndicate, it is reported, contemplates the installation of electrical and water-works systems in Plainview and in other towns in this section of the State, involving an expenditure of not less than $1,000,000. Electricity will be supplied for operating pumps for irrigation purposes and for other industries. H. C. Randolph, Plainview, is interested in the project.

## Pacific States

POULSBO, WASH.—The County Commissioners have granted the Poulsbo Lt. & Pwr. Co. a franchise to construct an electric-power plant and to erect and maintain transmission lines in all portions of Kitsap County.

TOPPENISH, WASH.—The Pacific Pwr. & Lt. Co. is planning to extend its transmission lines from Parker to Sawyer via Buena Station. Power service will be installed at several of the large ranches along the route. George I. Drennan is local manager.

VALLEYFORD, WASH.—Preparations are being made by the Valleyford Wtr. Co. for the installation of an electric-lighting system in Valleyford. Energy will be secured from the transmission lines of the Spokane & Inland Empire Ry. Co. Arthur E. Jones is president of the water company.

EUGENE, ORE.—Arrangements are being made by the Eugene Water Board to extend its electric transmission lines to the village of Walterville, 15 miles distant, to furnish electrical service there. Application has been made to the County Commissioners to install an electrical distributing system on the streets of Walterville, which is not incorporated.

OREGON CITY, ORE.—The county court has granted the Portland Ry., Lt. & Pwr. Co. a franchise to erect transmission lines along the county roads near the town of Monitor, in return for which the company agrees to light free the covered bridge near Monitor.

ALAMEDA, CAL.—Application has been filed with the State Railroad Commission by the Mountain Lt. & Wtr. Co. of Alameda County for authority to purchase the public utility water and electric-light plants at Brookdale, Santa Cruz County, and to issue bonds for improvements to the water and light plants, to cost $2,500.

REDDING, CAL.—The installation of a municipal electric-light plant in Redding is under consideration. Electrical service is now furnished by the Northern California Pwr. Co.

STOCKTON, CAL.—Improvements involving an expenditure of $285,000 are contemplated to the West Side Irrigation District and will include one 12-in. centrifugal pump directly connected to one 60-hp. motor, three 14-in. pumps to three 150-hp. motors, two 16-in. pumps to two 400-hp. motors, one 18-in. pump to one 500-hp. motor, 6600 ft. 48-in. and 12,900 ft. 54-in. redwood stave pipe, two main canals, one 52-ft. level and one 105-ft. level, and laterals. Hunter & Morton, Stockton, are local engineers.

ARCO, IDAHO.—The village of Arco has granted Richard W. Ferris a franchise to install and operate an electric-light plant and water-works system.

PROVO, UTAH.—Residents of Grand View Ward, comprising the south portion of Provo Bench, are planning to build a small power plant on Spring Creek to supply electricity for lamps and motors in that vicinity.

## Canada

NIAGARA FALLS, ONT.—Bids on the construction of a power canal from Niagara River to Queenstown, and for erection of a generating station on Smeaton Farm, a short distance this side of Brock's Monument, it is understood, will be asked early in January by the Ontario Hydro-Electric Power Commission.

NIAGARA FALLS, ONT.—The by-laws providing for the purchase of energy for the municipal lighting plants from the Ontario Hydro-Electric Power Commission, and to purchase from the Ontario Power Co. the transformers now in use at the lighting plant for $14,000, have been approved by the voters.

SHERBROOKE, QUE.—The Sherbrooke Ry. & Lt. Co., it is reported, is contemplating the construction of a substation.

## Miscellaneous

PETERSBURG, ALASKA.—The Town Council has authorized Fred C. Purinton, Petersburg, to visit cities on Puget Sound for the purpose of making investigations of the municipal electric plants with a view of establishing an electric plant in Petersburg.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until Nov. 23, under Requisition 199-E, for furnishing condulets, Bossert covers, marine fixtures, fuses, shade holders, receptacles, reflectors, switches and Munson slate. For further information address Major F. C. Boggs, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until Nov. 30, under Proposal 2045, for furnishing automatic pneumatic ejector, 130 gal. per minute capacity; transformers, panelboards, desk fans and white cotton waste. For further information address Major F. C. Boggs, general purchasing agent.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until Nov. 23, for furnishing under Proposal 1993-E, two 12-panel boards, 200 outlet boxes, 100 carbon brushes, 15,000 ft. molding and capping, miscellaneous condulets, magnet wire and electrical material. For further information address Major F. C. Boggs, general purchasing officer.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 9, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,159,346. Socket Shell; L. W. Andersen, Waterbury, Conn. App. filed March 30, 1915. Interlocking joint between shell and cap.

1,159,354. Electrical Testing Apparatus; H. J. Blakeslee, Hartford, Conn. App. filed Nov. 9, 1909. Compact construction.

1,159,359. Magneto Hand Generator; H. P. Clausen, Rochester, N. Y. App. filed March 22, 1911. For telephone work.

1,159,361. Electric Switch; R. C. Cole, Hartford, Conn. App. filed July 15, 1914. Armored type.

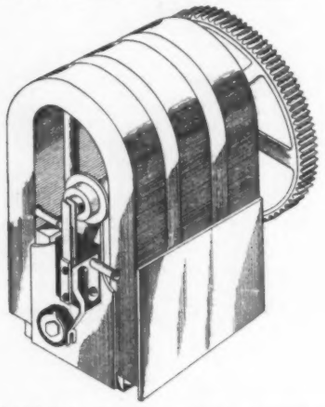
1,159,376. Process for Producing Acetic Acid from Acetylene by Electrolysis; C. Hansen and A. Weindel, Leverkusen, near Cologne, Germany. App. filed Jan. 26, 1914. Oxidation of acetylene of the anode.

1,159,383. Electric-Arc Lamp; R. Holsten, Charlottenburg, Germany. App. filed March 7, 1910. Combustible is supplied through a hollow electrode.

1,159,409. Electric Insulator; A. R. Muller, Walthamstow, England. App. filed June 15, 1912. Plurality of screw-thread-connected members.

1,159,451. Trolley Harp; C. Wetjen, New York, N. Y. App. filed April 1, 1912. Guards prevent jumping.

1,159,456. Electrical Connector; E. B. Wilcox, Meriden, Conn. App. filed June 18, 1915. Interchangeable lamp for one-wire or two-wire lighting systems.



1,159,359—Magneto Hand Generator

1,159,467. Automobile Horn; P. C. Burns, Chicago, Ill. App. filed March 4, 1912. Motor armature carries impacted balls.

1,159,484. Street and Station Indicator; H. A. Fleck and C. H. Fleck, Jr., Philadelphia, Pa. App. filed Oct. 16, 1914. Mounted on car and automatically operated.

1,159,508. Clock Movement; J. Lemaire, Drummondville, Quebec, Canada. App. filed Dec. 10, 1913. Impetus-maintaining means.

1,159,511. Arc-Lamp Electrode; George M. Little, Pittsburgh, Pa. App. filed March 3, 1914. Contains oxide of iron titanium and tungsten.

1,159,521. Signal Switch; B. Miller, German Valley, Ill. App. filed Oct. 27, 1914. Indicates at distance condition of switch.

1,159,536. Current Collector for Electric Railways; H. Schutte, Pittsburgh, Pa. App. filed July 14, 1910. Pantograph type.

1,159,547. Electric Switch; G. A. Tate, Chicago, Ill. App. filed March 27, 1913. Multi-break overload.

1,159,562. Switchboard Apparatus; J. A. Wotton, Montclair, N. J. App. filed Nov. 21, 1913. Mounting strip for telephone signal-lamp sockets.

1,159,567. Joint Insulator; C. O. Burton, Duluth, Minn. App. filed March 5, 1915. Made in identical halves.

1,159,587. Automatic Stop Motion; G. John and D. L. Lindquist, Yonkers, N. Y. App. filed Aug. 9, 1911. For elevators.

1,159,590. Dash-Pot Accelerating Device; D. Larson, Yonkers, N. Y. App. filed Dec. 22, 1908. Independent of the voltage.

1,159,595. Telephone-Exchange System; F. R. McBerty, New Rochelle, N. Y. App. filed July 27, 1910. Semi-automatic.

1,159,602. Thermal Circuit Closer; J. F. Scheuer, Two Rivers, Wis. App. filed June 17, 1914. Fusible type.

1,159,603. Telephone Device; H. E. Shreeve, Millburn, N. J. App. filed Feb. 17, 1914. Microphone construction.

1,159,612. Controlling Apparatus; A. Sundh, Hastings-upon-Hudson, N. Y. App. filed March 20, 1914. Inductive controlling system.

1,159,655. Terminal Structure; C. W. Davis, Edgeworth, Pa. App. filed Jan. 11, 1913. Two-part thimble construction.

1,159,668. Safety Device for Electric Switches; F. C. Harris, Duluth, Minn. App. filed June 11, 1914. Particularly for knife switches.

1,159,674. Electric-Circuit Regulator; G. Honold, Stuttgart, Germany. App. filed Dec. 20, 1913. Granular carbon in compressible container.

1,159,678. Trolley-Wheel Guard; W. L. James, West Homestead, Pa. App. filed April 13, 1915. Controlled by the trolley-replacing cord.

1,159,699. Water-Purification Apparatus; J. A. Murdock, Los Angeles, Cal. App. filed June 28, 1915. Operated by electrolysis.

1,159,701. Plug Socket; W. C. Neahr, Denver, Col. App. filed Sept. 28, 1914. Introduction of plug operates cut-out.

1,159,714. Electrical Selective Mechanism; A. H. F. Schaar, Oakland, Cal. App. filed Nov. 1, 1909. Uses single telegraph wire (forty-five claims).

1,159,730. System of Automatic Signaling for Electric Railways; F. Townsend (deceased), New York, N. Y. App. filed April 14, 1910. Block system for alternating-current roads.

1,159,765. Arc Lamp; C. Henrichsen, Pittsfield, Mass. App. filed July 11, 1913. Condensing chamber remote from the globe.

1,159,770. Coil Construction; R. M. Hyde, Pittsfield, Mass. App. filed Dec. 26, 1914. For transformers, etc., mechanical features.

1,159,793. Automobile Signal; J. C. Perry, Ocean Grove, N. J. App. filed July 15, 1915. Semaphore device controlled by button on wheel.

1,159,800. Maximum-Demand Indicator; L. T. Robinson, Schenectady, N. Y. App. filed Dec. 31, 1913. Watt-hour meter.

1,159,807. Trolley; F. Sczavnyicki, Bridgeport, Conn. App. filed Aug. 31, 1914. Opposite L-shaped guards.

1,159,818. Electromagnetic Switch; J. J. Wood, Fort Wayne, Ind. App. filed Nov. 20, 1914. For starting motors.

1,159,826. Machine for Counting Paper Money; J. P. Buckley, Washington, D. C. App. filed July 30, 1910. Automatically stops after counting predetermined number.

1,159,855. Special-Service Telephone System; T. G. Martin, Chicago, Ill. App. filed May 11, 1912. Automatically disconnected when subscriber removes receiver from hook.

1,159,869. Vapor-Electric Device; Y. Sakai. East Pittsburgh, Pa. App. filed June 14, 1912. Readily insertible anode.

1,159,884. Electrode-Cooling System; L. M. Aspinwall, Wilkinsburg, Pa. App. filed Jan. 23, 1915. Uses large amount of cooling fluids.

1,159,892. Electrical Protective Device; H. W. Brown, Ithaca, N. Y. App. filed Dec. 9, 1913. Quick-operating relay.

1,159,900. Vapor-Electric Device; F. Conrad. Swissvale, Pa. App. filed June 21, 1912. Prevents condensation of vapor on anodes.

1,159,903. Electrode-Cooling System; D. C. Davis. Swissvale, Pa. App. filed Jan. 23, 1915. Both anodes cooled by single stream.

1,159,904. System of Electrical Distribution; H. P. Davis and F. Conrad, Pittsburgh, Pa. App. filed Dec. 31, 1908. For supplying power to feeder and trolley circuits.

1,159,905. Fire-Alarm System; W. L. Denio. Rochester, N. Y. App. filed July 12, 1912. Local and main alarms for schools, etc.

1,159,908. Electric Gas Lighter; R. F. Dowdy, Roanoke, Va. App. filed Feb. 26, 1915. Attachable to alternating-current lighting circuit.

1,159,910. Cooling System; G. M. Eaton and S. W. Farnsworth, Pittsburgh, Pa. App. filed July 13, 1914. Maintains different parts at different temperatures.

1,159,914. Starting Electrode for Vapor-Electric Apparatus; S. W. Farnsworth, Pittsburgh, D. E. Carpenter, Wilkinsburg, and L. E. Frost, Pittsburgh, Pa. App. filed Feb. 5, 1914. Readily adjustable construction.

1,159,915. Starting Electrode for Vapor-Electric Devices; S. W. Farnsworth and O. P. Schuster, Pittsburgh, Pa. App. filed Feb. 5, 1914. Automatic adjustment.

1,159,916. Electrode for Vapor-Electric Apparatus; S. W. Farnsworth, Pittsburgh, D. E. Carpenter, Wilkinsburg, L. E. Frost, Pittsburgh, D. H. Rose and E. F. Sipher, Wilkinsburg, Pa. App. filed Feb. 21, 1914. Prevents short-circuiting within apparatus.

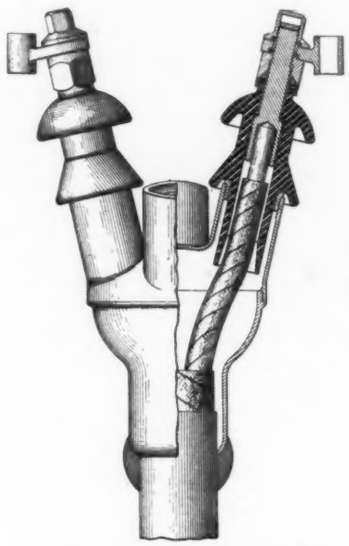
1,159,920. Trimming Indicator for Arc Lamps; R. Fretzdorff, Leutzsch, near Leipzig, Germany. App. filed July 26, 1913. Operates as carbon is fed.

1,159,922. Vapor-Electric Device; L. E. Frost, Pittsburgh, Pa. App. filed Feb. 5, 1914. Removes causes of short-circuits.

1,159,936. System of Electrical Distribution; F. W. Harris, Wilkinsburg, Pa. App. filed Sept. 6, 1910. Automatically cuts out abnormal feeder circuits.

1,159,944. Vapor-Electric Device; R. P. Jackson, Edgewood Park, Pa. App. filed Nov. 16, 1911. Anode shields.

1,159,969. Detector for Wireless Telegraphy; C. O. Lorenz, Port Arthur, Tex. App. filed Nov. 7, 1910. Body of chalcocite and body of zinkite.



1,159,655—Terminal Structure

1,160,013. Railway Signal; R. H. Todd, Philadelphia, Pa. App. filed April 22, 1914. Informs engineers of trains in same block.

1,160,063. Electric-Lamp Socket; F. P. Gates and G. A. Gauthier, Hartford, Conn. App. filed Feb. 23, 1915. Locking socket.

1,160,072. Method of and Means for Translating Sounds; R. E. Hall, Portland, Ore. App. filed Aug. 18, 1914. For wireless work.

1,160,087. Dynamo-Electric Machine; A. H. Neuland, San Francisco, Cal. App. filed Jan. 25, 1912. High power; small size.

1,160,092. Electrical Control System; E. W. Stull, Wilkinsburg, Pa. App. filed May 29, 1911. High-voltage and low-voltage interurban electric railway.

1,160,094. Indirect-Lighting Fixture; H. C. Adam, St. Louis, Mo. App. filed Jan. 11, 1915. Bowl-shaped shield close to top reflector.

1,160,097. Telegraph Repeater; W. Finn, Bloomfield, N. J. App. filed Jan. 26, 1915. For automatic high-speed work.

1,160,101. Machine for Perforating Master Sheets for Typewriter Operators; L. R. Roberts, Rutherford, N. J. App. filed Aug. 12, 1911. Punches very heavy cards.

14,007 (reissue). Apparatus for Cleaning Articles; E. L. Couch, Hartford, Conn. App. filed Jan. 28, 1915. Original patent No. 1,068,568, dated July 29, 1913. Has a movable belt of electrolytically active material.